The Journal of ELECTRICITY POWER and GAS

DEVOTED TO THE CONVERSION, TRANSMISSION and DISTRIBUTION OF ENERGY.

VOL. XIV.—No. 6 SAN FRANCISCO, CAL., JUNE, 1904. YEARLY SUBSCRIPTION - $2 00
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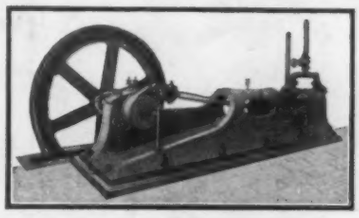

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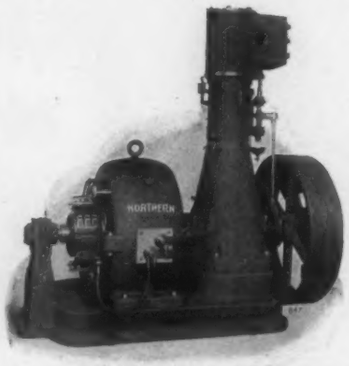

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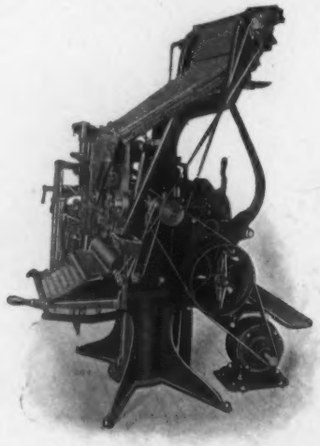

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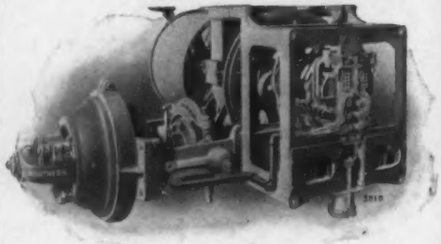

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Devoted to the Conversion, Transmission and Distribution of Energy.

VOLUME XIV. SAN FRANCISCO, CAL., JUNE, 1904. NUMBER 6

In the Old Historic Town of Monterey.

OLD Monterey—shrine of the Native Son of the Golden West because of its prominence in the early history of California, and mecca of the tourist because of the unequalled magnificence of its world-famed caravansary near by—has of late awakened a new interest in the minds of the electrical fraternity of the Pacific Coast by reason of the most cordial invitation which its Chamber of Commerce has extended to the Pacific Coast Electrical Transmission Association to hold its Eighth Annual Convention within its gates. Now that this invitation has been accepted, the present month will witness the pilgrimage of many "Transmissionites" from all quarters of the West to that hospitable old town, where every effort will be taken to insure a most successful and enjoyable meeting.

More than one foreign country covets Monterey because of its magnificent storm-free and fathoms-deep bay, which could well harbor the navies of the world. On a broad cove at its southward lies the old historic town of Monterey, to the west but two miles is Pacific Grove, an ideal home place, while less than a mile to the east is famed Del Monte—a city in itself, with its hundred odd acres of grounds that are a marvel of floriculture. The unwonted popularity of this trinity of resorts attests the superiority of this locality, which has an equal nowhere. The Monterey peninsula is, indeed, one of the most

FOR BOATING MONTEREY BAY IS AS PLACID AS A VENETIAN CANAL

THE GLASS BOTTOMED BOAT REVEALS SUBMARINE GLORIES

charmingly picturesque in all California, for aside from the natural beauties of landscape, its ocean environment gives it a phenominally mild and even climate at all times.

More of interest centers in this region than at any other point on the Pacific Coast. Monterey is the best remaining representative of the early Mexican days to be found in California, and the Carmel and San Carlos missions are among the best preserved of these ever interesting structures. Interesting landmarks of the beginning of American occupation abound—here is the spot where the American flag was first raised on the Pacific Coast; here is Fremont's fort, a relic of the Mexican War, while Colton Hall, the seat of the first California Legislature, is in fine preservation, and has been made a permanent museum of the history of this interesting time.

The sea life of Monterey Bay is most wonderful. Glass-bottomed boats turn the whole shore into an aquarium, and the view from one of these is like fairyland, fish in every conceivable variety disport themselves in submarine gardens of entrancing interest, while the entire floor of the sea is covered with shell-fish of surpassing beauty. This wealth of sea-life, which is greater than that of any other body of water in the world, has brought about the location of the Hopkins Seaside Laboratory at Pacific Grove, and made the region famous among scientists. Popular interest in these matters is provided for in a free museum, which makes submarine life accessible to the amateur. Pacific Grove along its whole extent fronts Monterey Bay, and the ocean is less than a mile off. The coast of both bay and ocean is rugged at this point, flanked by bold cliffs against which the surf dashes in unbroken sweep, while at the same time there are innumerable small coves with sheltered and easily accessible sand beaches. These beaches are strewn at all seasons with beautiful shells and delicate sea mosses, the gathering of which is an untiring delight.

Then there is the famous seventeen-mile drive, the chief charm of which lies in its variety. Beginning at the quiet town of Monterey and making its way for three miles through a virgin forest of pines and oaks, all gracefully hung with a delicate lace moss, while underneath is a bewildering tangle of vines and ferns, the road suddenly opens on the shore of the Pacific and follows its bold bluffs and pounding breakers for five miles, past rocks covered with legions of wild birds and by one of the largest seal rookeries on the coast. This rookery is situated only three hundred yards from the shore, and is at all seasons occupied by great herds of huge seals. At Cypress Point the road crosses the habitat of the Monterey cypress, a forest of hoary and grotesque giants, and turning in upon Carmel Bay passes Pebble Beach, covered with the rarest pebbles, thence through a picturesque Chinese fishing village, and threading its way up a fine mountain canyon and over the summit of the peninsula, brings Monterey and Del Monte into full view nestled close by the shore of the bay, which here makes a sweep as fine as that of the Bay of Naples. A trip through the quaint town, teeming with objects of historic interest, and the circuit of the park and grounds of the Hotel Del Monte, unsurpassed by the celebrated parks of the old world, and the round of the United States military reservation complete the drive. To take this drive is the experience of a life time.

Again, a further interest in this locality lies in the beautiful Hotel Del Monte, the grounds of which are always open to the public and supply one of the chief attractions of the region. They are reached easily by trolley car from Monterey, which is but three-quarters of a mile distant. Del Monte is a dream of beauty. Its setting is the finest of any hotel in the world. Its park of native oaks and pines with its finish of lawns and fine flower parterres is not surpassed in charm by any of the world's famous parks. The background is of the finest mountains, and in front of the hotel the ever-glorious

THE HOTEL MONTEREY, MONTEREY, CAL.

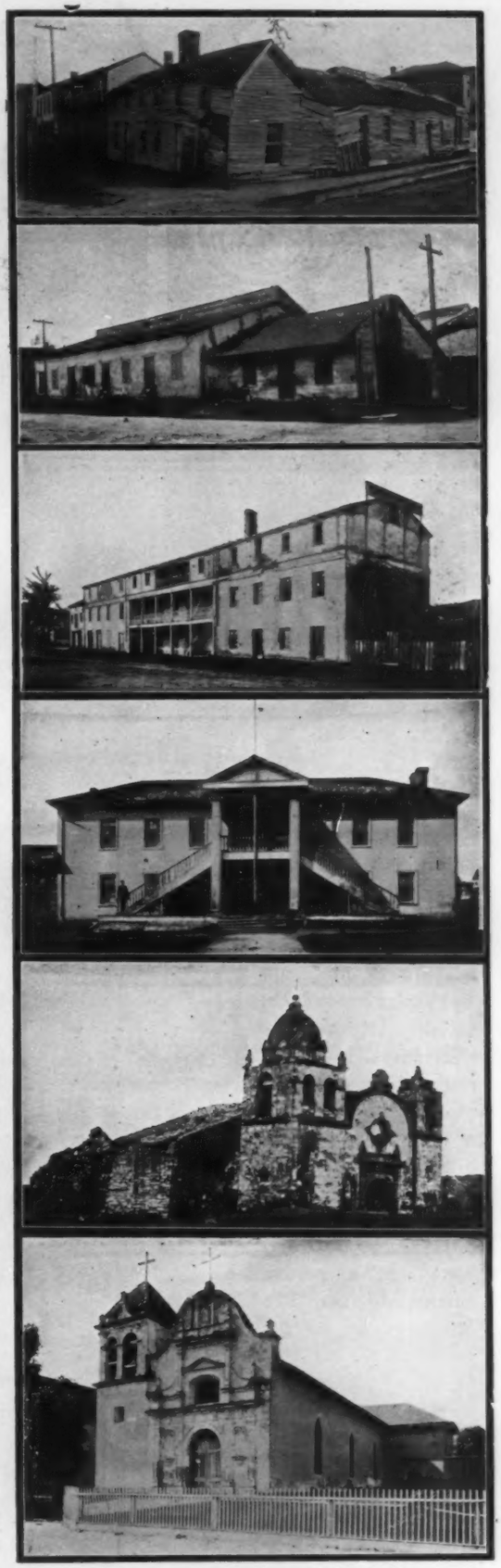
IN THE OFFICE OF "THE MONTEREY"

bay. Climate favors the growth of plants of all latitudes, and here may be found mingled pine and palm, orange and oak; cactuses from Arizona fill a whole section of the grounds, while flowers and trees of the temperate climes grow with lavish luxuriance all the year round. The spacious lawns covering 125 acres are tastefully broken into flower parterres and interspersed with the finest trees and shrubs. The hotel itself rises in the midst of all this beauty, a gem appropriately set, and is a model of luxurious comfort, every appointment is perfect.

By a resolution of the Executive Committee, attendants to the convention who leave San Francisco are requested to take the "Del Monte Express," leaving Third and Townsend streets at 3:00 p. m. on Monday, June 20th, reaching Monterey at 6:50 p. m. The "Sunset Limited," leaving the same depot at 5:45 p. m., connects with a train that reaches Monterey at 10:15 p. m., but it is urged that all take the "Del Monte Express."

The Southern Pacific Company has granted a special round-trip rate to attendants to the convention of one and one-third of the one-way fare to Monterey from all points on its system, provided fifty or more tickets are sold. When you purchase your ticket (or tickets), buy a one-way ticket, paying full fare therefor, and request the agent to give you a convention receipt-certificate attesting its purchase. If fifty or more such certificates are delivered to the Secretary of the Association at Monterey, he will endorse them in the name of the Association, whereupon the railroad agent at Monterey will accept each certificate and one-third of the return fare in payment for the full return fare. Tickets may be purchased any time within fifteen days prior to the date of the meeting, and stopovers may be had on tickets to Monterey, but certificates must be presented for the return trip within forty-eight hours after the close of the convention. Do not fail to request the agent for the above certificate when purchasing your ticket to Monterey, for while the reduction of one-third of the trip rate will not mean much to the man from San Jose, for instance, it is a material sum to him who comes from Portland, or Ogden, or Los Angeles.

Visitors to the convention will be delighted with the accommodations which await them at the Hotel Monterey, a new but small caravansary of exquisite apportionments which has been but lately built in Old Monterey, and which has been selected as the Association headquarters during the convention. It is a fireproof hotel of some seventy odd rooms, located on the principal business street of the town, with rooms en suite and single, all elegantly furnished in the height of daintiness and comfort. Every modern appliance that will



CALIFORNIA'S FIRST WHITE HABITATION
CALIFORNIA'S FIRST THEATRE. JENNY LIND SANG HERE
WASHINGTON HOTEL
COLTON HALL WHERE THE FIRST STATE LEGISLATURE MET
MISSION EL CARMEL
THE OLD SAN CARLOS MISSION

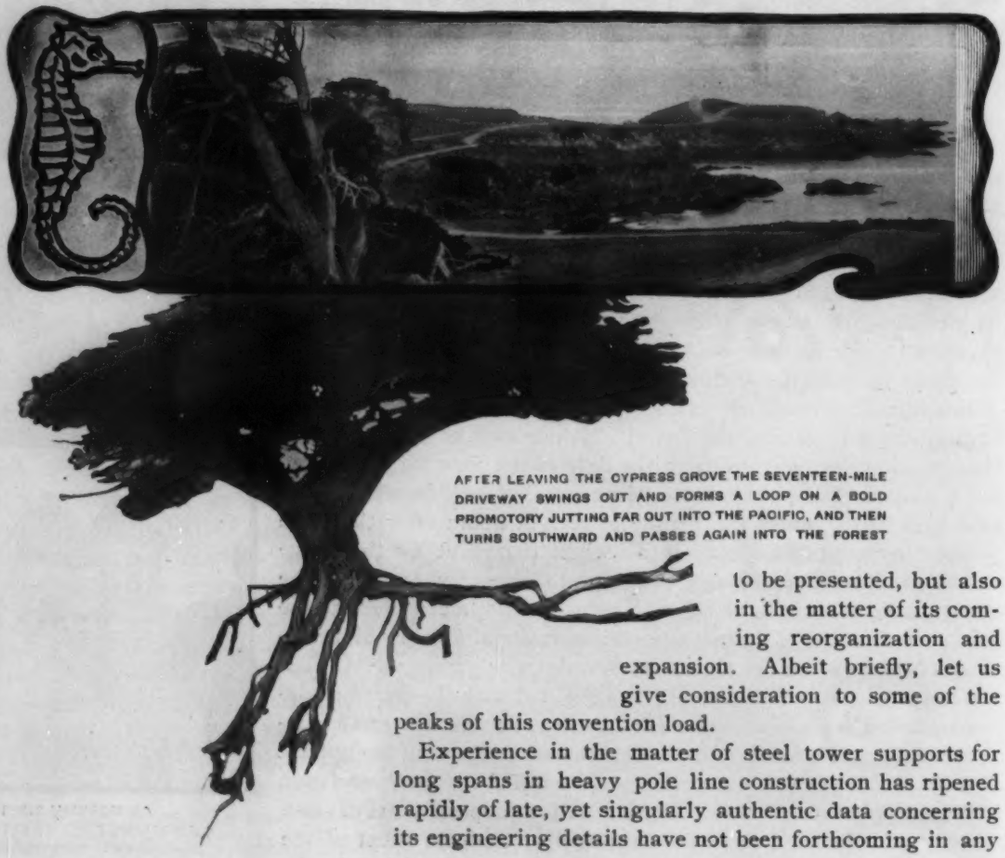
LAGUNA DEL REY, A CHARMING LITTLE LAKE, ADJOINS THE GROUNDS OF HOTEL DEL MONTE ON THE EAST, AND IS A ROMANTIC AND BEWITCHING SPOT.

evening, and delegates to the convention will attend it as guests of the Association.

Contrary to the custom of the past two conventions, a special invitation is extended to the ladies to attend the session. An elaborate programme is being prepared by the Monterey Chamber of Commerce and the ladies of the town for their entertainment, which will include a ride over the world-famed seventeen-mile drive and a trip on the bay in a fleet of launches. Music will be provided for all occasions where it is suitable, so bring your wives and friends and make merry.

All this preparation for the comfort and pleasure of the attendants to the convention is but an iota in comparison with the time and labor that has been devoted to the preliminary details pertaining to its business end, and now as the day approaches it is definitely known that Monterey is to witness a most important epoch in the history of the Transmission Association, not only from the viewpoint of the importance and interest of the papers to be presented, but also in the matter of its coming reorganization and expansion. Albeit briefly, let us give consideration to some of the peaks of this convention load.

add to the well-being of its guests is to be found within its walls; its dining rooms, public and private, are gems; palms and flowers are in profusion everywhere; it is lavishly lighted by electricity; it has an electric elevator possessing the novelty of a car of polished brass; its rooms are sumptuously furnished, even to a modern interior telephone service, and a perfect cuisine all make The Monterey by far the finest small hotel to be found in any city on the Pacific Coast. The hotel has granted a special rate of $3.00 per day (American plan) to attendants. The banquet will be held at "The Monterey" on Wednesday



AFTER LEAVING THE CYPRESS GROVE THE SEVENTEEN-MILE DRIVEWAY SWINGS OUT AND FORMS A LOOP ON A BOLD PROMOTORY JUTTING FAR OUT INTO THE PACIFIC, AND THEN TURNS SOUTHWARD AND PASSES AGAIN INTO THE FOREST

Experience in the matter of steel tower supports for long spans in heavy pole line construction has ripened rapidly of late, yet singularly authentic data concerning its engineering details have not been forthcoming in any

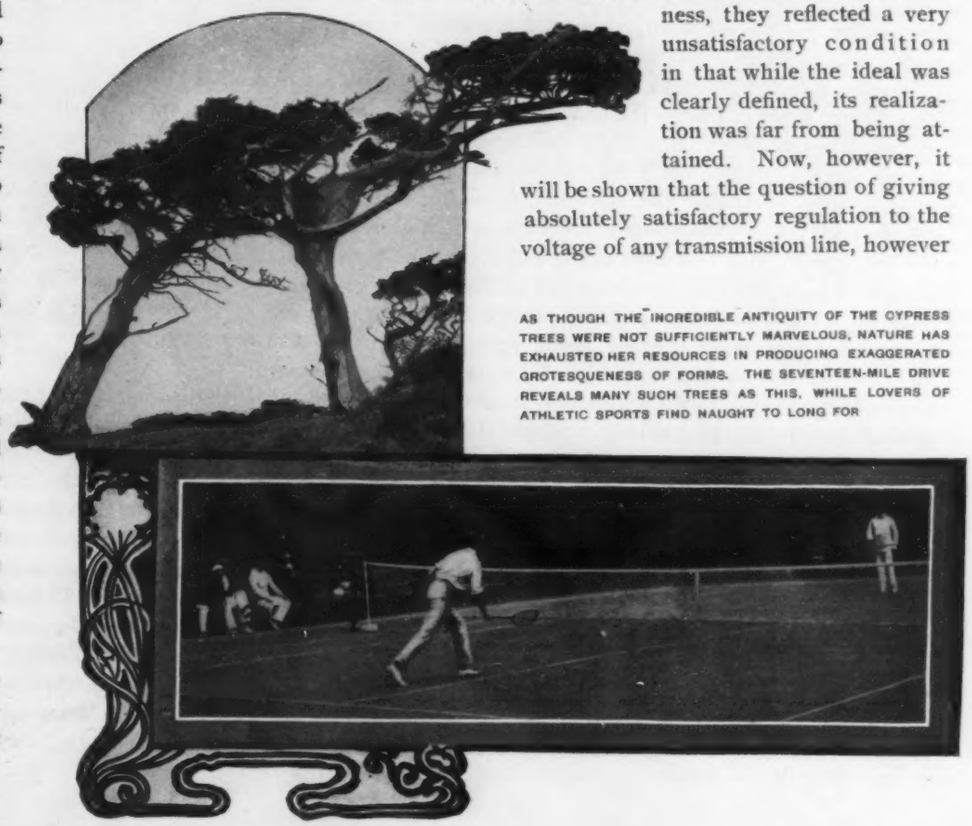
ROWING AND SAILING ON THE BAY ARE PLEASANT PASTIMES. AT MONTEREY SAIL AND ROW BOATS ARE ALWAYS READY FOR AN OUTING, AND HERE ARE SEVERAL MODERN GLASS-BOTTOMED BOATS THROUGH WHICH MAY BE SEEN THE WONDERS OF THE MARINE GARDENS.

instance. This is a subject of paramount importance, for obviously the exertion of any effort which will tend to strengthen the link that is inherently the weakest in the chain of structural detail in transmission plants will be regarded as a long step in the right direction. The first and undoubtedly the most important installation of this character in the world is that of the Guanajuato Power and Electric Company, of Mexico. This plant was erected under the consulting engineership of Robert McF. Doble, who will deliver a lecture upon it at the Monterey Opera House on the evening or Tuesday, June 21st. This lecture will be replete with engineering detail, and as it will be illustrated by upwards of seventy-five stereopticon slides, it will be invaluable to the attendants to the convention as well as of interest to the public at large. If time admits, the usual discussion will follow the reading of the paper.

Co-incident with the installation of the Guanajuato plant, the Pacific Light and Power Company and The Edison Electric Company, both of Los Angeles, were making practical experiments on the use of extremely high voltages in transmission service—the former dealing more particularly with the question of insulators, and the latter more especially in the direction of reducing the number of poles and insulators used in a given distance. The full details and results of these experiments made by The Edison Electric Company will be given by C. A. Copeland, of the company named, in a valuable paper.

Here, then, are two potent factors in heavy transmission line construction—steel towers and pole spacing—which are to receive consideration at the hands of men who are the foremost specialists of the Pacific Coast in their branches of transmission engineering, and to hear their papers and to participate in the discussion of them will be a privilege that no engineer can afford to neglect.

In the past, page after page of the Transactions of the Transmission Association have been filled with spirited discussions relative to the regulation of long distance high tension transmission lines, and, to speak with frankness, they reflected a very unsatisfactory condition in that while the ideal was clearly defined, its realization was far from being attained. Now, however, it will be shown that the question of giving absolutely satisfactory regulation to the voltage of any transmission line, however



AS THOUGH THE INCREDIBLE ANTIQUITY OF THE CYPRESS TREES WERE NOT SUFFICIENTLY MARVELOUS, NATURE HAS EXHAUSTED HER RESOURCES IN PRODUCING EXAGGERATED GROTESQUENESS OF FORMS. THE SEVENTEEN-MILE DRIVE REVEALS MANY SUCH TREES AS THIS, WHILE LOVERS OF ATHLETIC SPORTS FIND NAUGHT TO LONG FOR

long or at whatever character of load, is a dead issue, and that this almost unbelievable assertion reflects the cold, hard truth will be demonstrated in papers to be presented by C. W. Hutton and J. A. Lighthipe, who will relate the conditions which existed in the cities of Sacramento and in Spokane respectively. In Sacramento the difficulty rested in a local four-wire, three-phase load delivering mixed power and lighting service; in Spokane the local pressure line was badly—frightfully, in fact—shaken up by reason of induction motor hoists in big units at the Coeur d'Alene miles one hundred miles or more away. No more severe conditions than those which existed in Spokane are to be found, yet the cure applied has been as perfect and permanent as it is simple and universal. Mr. Lighthipe will give the full diagnosis of the case and describe the remedy.

In this day of specialists it takes an expert to deal competently with any branch of electro-technics, and aside from engineers who are identified with the great Bell and Independent interests, there is probably no more competent telephone engineer on the Pacific Slope than H. G. Aylsworth, San Francisco, manager of the house of The Kilbourne & Clark Co., Seattle. Mr. Aylsworth will present a paper on the use of telephone apparatus operating on lines maintained on poles that support high tension transmission circuits, in which he describes particularly a new form of telephonic apparatus that has been built upon an original suggestion by R. W. Van Norden for use on the telephone line of the Central California Power Company, a particular novelty and utility of which rests in the fact that by its use there is assured a positive and absolute immunity from personal or physical injury in the handling of any receiver or transmitter on the system, regardless of any abnormal condition which may exist on the external line circuit.

Reference to the personal hazard existing in transmission service brings to mind the fact that during the convention there will be presented the full report of the committee originally appointed during the session of 1902 to draft rules governing the scientific proceedure to be followed in the resuscitation of persons suffering from electric shock, and this invaluable report will be supplemented by a physical demonstration by Professor Frederick H. Killick on the subject. Professor Killick is an expert on resuscitation, having spent years in traveling through the life saving hospitals of England, France, Holland and Belgium solely with the view of informing himself concerning the methods of resuscitation practised in these various countries. In addition, Professor Killick has similarly acquired an enormous amount of information of like nature from American sources. It is the consensus of medical opinion that injury from electric shock is an acute form of asphyxiation, the resuscitation from which is best effected by inducing artificial respiration in any one of these several methods followed in bringing about resuscitation from apparent death due to asphyxiation from gas or submersion. Instances are on record where life has been restored from suspended animation to perfect health after thirty minutes submersion, and in Professor Killick's own experience he has restored life in two instances wherein the patients were under water for twenty minutes or more. These conditions present an exact parallel to that which exists in serious electric shock, for the method to be followed in saving life in the one is a counterpart of that of the other. No emphasis need be placed on the importance of this subject, because its humanitarian standpoint alone makes it paramount to all other interests.

Another report to be presented to the convention will be that of the special committee appointed during the last session to recommend a standard system of polyphase distribution. The importance of this committee's work is self-evident, and as it rests in the able hands of Messrs. Holberton, Balch and Lighthipe, some far-reaching results are anticipated. R. W. Van Norden, editor of the "Wrinkle Department," has been laboring assiduously during his term of office upon the collection of new suggestions, ideas and experiences, all of which are collated under the generic name of "wrinkles," and will be presented during the convention. Noteworthy among the remaining contributions may be listed a paper by A. M. Hunt, late managing engineer of the Independent Light and Power Company, San Francisco, who submits a new and original chart for the equitable determination of rates for lighting and power service, with due regard to load factor; by R. W. Van Norden, who describes the difficulties attending the maintenance of canals and ditches at high altitudes during the winter months, and with particular reference to overcoming interruptions from the accumulation of anchor ice and the occurrence of land and snowslides; by A. J. Bowie, Jr., who submits a paper detailing the principal points of comparative efficiencies in transmission lines which are regarded as projected to deliver power into the city of Los Angeles from the Kern County oil fields, using oil as a fuel for steam-electric power development, and from the Kern River, using hydro-electric power; by W. W. Briggs, who describes various interesting shop practices of the Westinghouse Electric and Manufacturing Company in building high tension power apparatus, the same being illustrated by many stereopticon views; and by H. A. Russell, who will lend diversion to the routine discussion of engineering problems by presenting a paper of humorous trend on "The Experiences of a Salesman."

A striking innovation for the Transmisson Association will be the inauguration of an exhibition hall which is to become a permanent adjunct of all future conventions. In this hall there will be exhibited at Monterey many of the most recent and interesting products of the leading electrical manufacturers of the country. Prominent among those who have already secured space therein are the General Electric Company, Stanley Electric Manufacturing Company, the Northern Electrical Manufacturing Company, The Electric Storage Battery Company and other manufacturers whose Pacific Slope interests are represented by Messrs. C. C. Moore & Co., the California Electrical Works, the Kilbourne & Clark Co., the

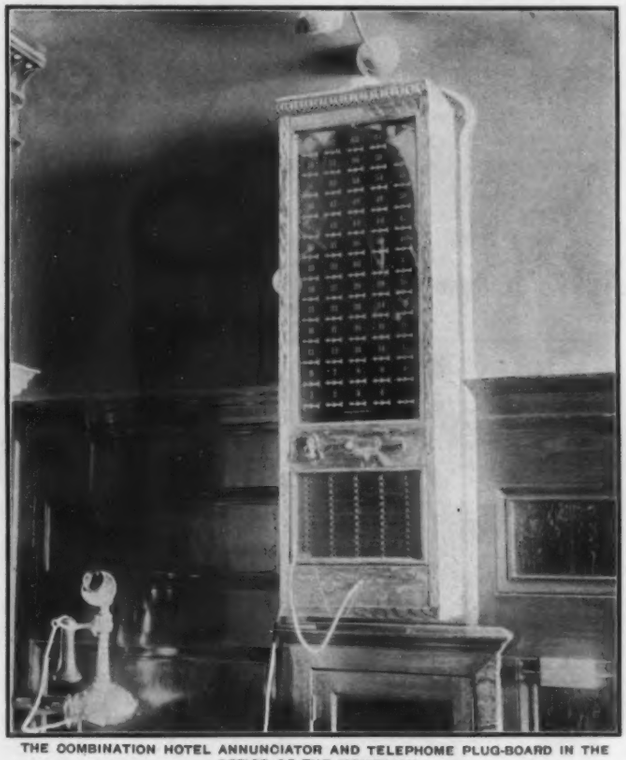
Wagner-Bullock Electric Company and other well known concerns, will give exhibits in actual operation.

This list of papers, then, together with the magnificent quarters which the Hotel Monterey extends, the cordial welcome which is in store from citizens of the old historic town, the varied programme for the entertainment of the guests and the sterling quality of the exhibition of electrical products which is to be made, all give assurance to the knowledge that the Eighth Annual Convention of the Pacific Coast Electric Transmission Association will be the most memorable one in its history.

THE TELEPHONE SYSTEM OF HOTEL MONTEREY.

BY H. G. AYLSWORTH.

AS the Transmission Association has selected "The Monterey," at the old town of Monterey, for the headquarters of its coming annual convention, those who attend, being of electrical tendencies, will find much to interest in the telephone system of that most excellent hotel, in fact the completeness of its telephone system alone serves as an index to the superiority of its general equipment.



THE COMBINATION HOTEL ANNUNCIATOR AND TELEPHOME PLUG-BOARD IN THE OFFICE OF THE MONTEREY

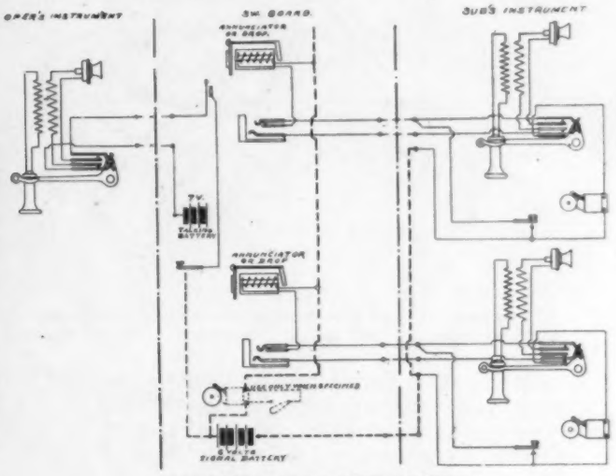
As a rule it has been the practice in installing small telephone systems heretofore to get the cheapest instrument in the market without regard to quality or workmanship. The builders of the Hotel Monterey, however, went into this matter very thoroughly, and wisely decided that the best equipment would be the cheapest in the long run, with the result that while the installation is a small one, it has several features which will commend themselves to those who contemplate much more extensive systems.

The telephone wiring throughout the house was done with No. 18 weatherproof wire, an individual pair running from each room instrument to the switchboard, the tip side of this pair and the common battery wire being used for ringing purposes. The installation consists of a sixty-five number plugboard equipped with sixty-five three-point jacks, plug, cord and ringing key. An inspection of the wiring diagram will show how simply the seemingly complicated set can be connected up.

There are two sets of batteries used. The talking battery consists of five cells of No. 2 Samson battery and the signaling battery of four cells of No. 2 Samson battery. These batteries are in duplicate, and by means of a double-pole, double-throw switch located on the lower part of the right hand side of the switchboard they can be used alternately, thus getting the maximum service from the battery.

The room instruments consist of a golden oak sub-base on which is mounted a four-inch Monitor vibrating bell, a Midget push-button and a triplet set consisting of hook switch, induction coil, transmitter and receiver. The instrument is exceedingly well assembled, and is an ornament rather than a detriment to the appearance of the room.

As will be seen by referring to the wiring diagram, the receiver is connected directly across the secondary of the induction coil, the primary of the induction coil being in series with the transmitter line and battery. The occupant of room, on wishing to communicate with the office, pushes the Midget button, which rings the annunciator bell and throws the drop on the switchboard. When the hotel clerk inserts the talking plug into the corresponding jack, the ringing battery is cut off from the line and the two instruments are working in series. Should the office desire to ring up a room to ascertain if the occupant is in, the clerk simply inserts the plug in the proper jack and depresses the ringing key, which rings the vibrating bell on the telephone.



WIRING DIAGRAM OF THE HOTEL MONTEREY

One thing particularly noticeable in this installation is the absolute freedom from induction or cross-talk and also the clearness with which the instruments work. There are absolutely no overtones transmitted, and it is

possible to whisper into the transmitter and be clearly understood at the other end. This is due in part to the fact that there are no impedence coils on either side of the battery, and also to the transmitters, which are of the latest and most approved design of the Stromberg-Carlson Telephone Manufacturing Company.

WAVE FORM VARIATIONS OF A LONG DISTANCE LINE.*

BY PROFESSOR GEORGE H. ROWE.

THAT portion of the transmission system of the California Gas and Electric Corporation which is known as the Standard Division, by reason of its building and former ownership by The Standard Electric Company of California, appears on the map given herewith as Figure 5, and it was on this so-called Standard line that the following oscillographic curves

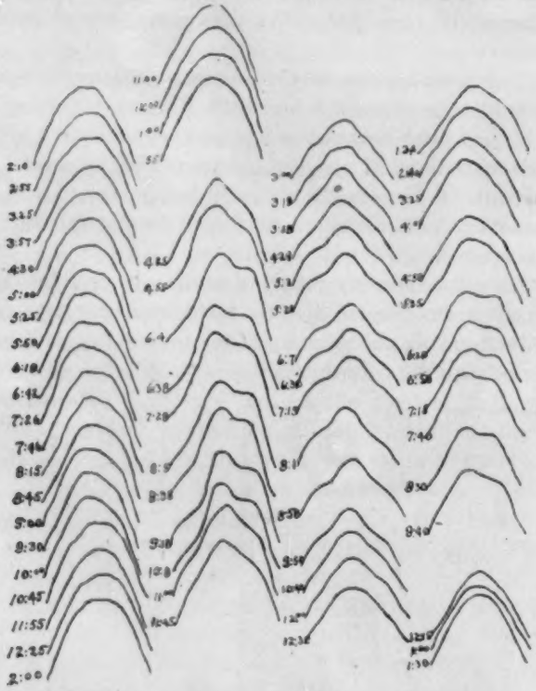


FIGURE 1. ELECTRA. FIGURE 2. SAN JOSE. FIGURE 3. STANFORD. FIGURE 4. SAN FRANCISCO

were taken. At the head of the system, Electra, the power house contains five 2000-kilowatt, three-phase generators of the S.K.C. inductor type, each giving 2200 volts at sixty cycles per second. These generators are supposed to have an inherent regulation of 3 per cent. on full non-inductive load, and 15.5 per cent. on full kilovolt-ampere load, 70 per cent. power factor. The normal exciting current for full load, 100 per cent. power factor, is 150 amperes at 2200 volts, with a limiting field current of 250 amperes.

The bay circuit, shown in Figure 5, is fed from two banks of three transformers each, both high and low tension circuits of which are △-connected. The ratio of transformation is 16.4, and therefore the line pressure is above or below 36,000, depending on the load and power factor of the system. Besides the bay circuit, several mining circuits extend to neighboring mining camps in Amador and Calaveras counties. The maximum length of these is about thirty miles. They are operated independently of the bay circuit at about 17,000 volts. The bay circuit lines, consisting of aluminum cables, extend to San Jose, a distance of 113.6 miles; to Oakland, by way of Mission San Jose, a distance of 128.8 miles, and to San Francisco, by way of Alviso, a distance of 153 miles. The calculated charging current of the system at 40,000 volts is about 30.3 amperes on the assumption of a sine wave. From the generators this would mean 500 amperes line current.

In Figure 6 will be found curves of observations taken on January 16, 1904. The power curve is derived from fifteen-minute readings of the integrating wattmeters, and is probably considerably in error, both on this account and on account of the large leading current.

It is difficult to give an accurate idea concerning the nature of the load. At Stockton are two 150-kilowatt synchronous motor-generator sets. The San Jose division contains one 250-kilowatt and one 150-kilowatt synchronous motor-generator set, both used for street railway and general power work, the generators being operated in parallel with a storage battery. The direct current motors range in size from 0.5 to 20 horsepower, and aggregate about 500 horsepower. There are also induction motors operating from the lighting circuits ranging in size from one to seventy-five horsepower, and aggregating about 300 horsepower. The total peak supplied to the San Jose substation is about 1000 kilowatts.

The San Mateo division is operated from the substation at Redwood. Distribution is made at 6000 volts, two-phase, to neighboring small towns. Induction motors in this division range in size from one to thirty horsepower, and aggregate about 500 horsepower, constituting chiefly a day load. The maximum load supplied to the station occurs between the hours of 5 and 9 p. m., giving a peak of about 400 kilowatts.

At the San Francisco substation, the low tension circuits are Y-connected with the neutral grounded, and supply power at 4000 volts between lines to station *B*, and to station *C* of the San Francisco Gas and Electric Company. At station *C* are two 500-kilowatt synchronous motor-generator sets, and at station *B* there is one 400-kilowatt synchronous motor-generator set. Station *B* also contains two 1200-kilowatt and one 600-kilowatt General Electric revolving field generators, one or more of which were operated in parallel during these tests with the Standard system,

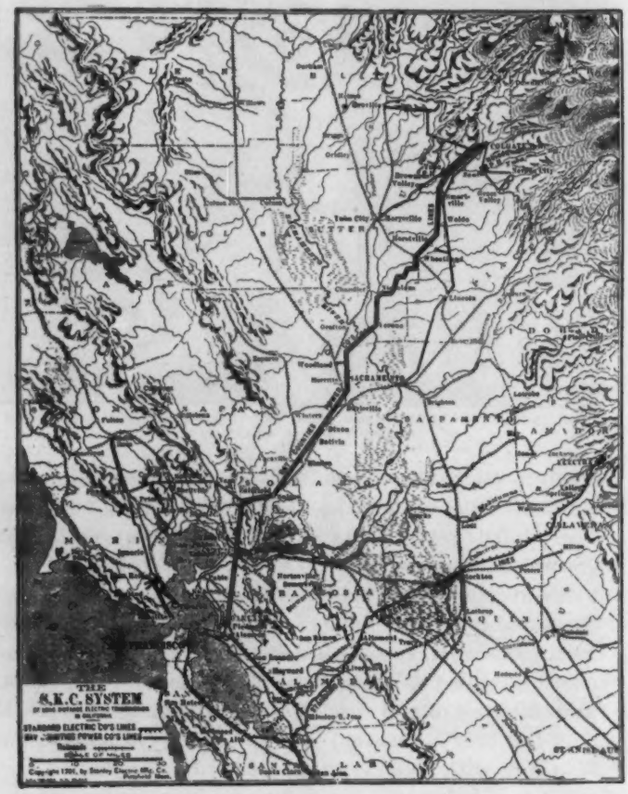


FIGURE 5.

*A paper presented before the 187th meeting of the American Institute of Electrical Engineers, New York, May 17–18, 1904.

being thrown in at about 5:30 p. m. and off at about 10:30 p. m. The peak was about 2000 kilowatts. These were the conditions during the tests. Since the consolidation of the Standard and Bay Counties systems, the above description does not hold.

The instrument with which the following tests were made was the well known Blondel oscillograph. Briefly, it consists of two

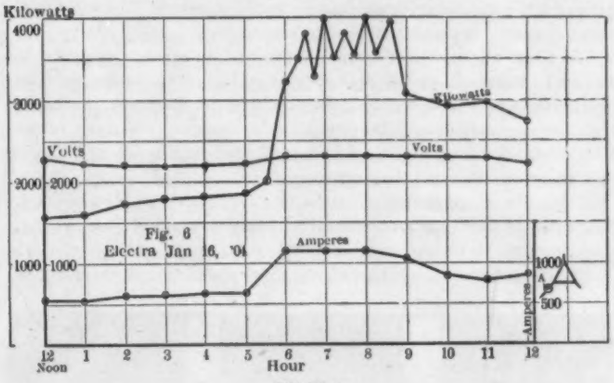


FIGURE 6.

thin strips of soft iron stretched vertically between the poles of a powerful permanent magnet. Very small mirrors are attached to these strips, and each strip and mirror is placed in a tube containing glycerine or vaseline oil. The natural frequency of the instrument, as given by the maker, is about 1000 cycles per second. About each of the mirrors as centers, two bobbins or coils serve to produce fields, one proportional to the current and the other proportional to the electromotive force. The current coil required about ten amperes to produce a convenient deflection on the plate, and the electromotive force about 0.333 ampere. A diagram through a vertical section of the instrument is shown in Figure 7. Light from the arc A passes through the slits S through the small lens L in the oil tube to the mirror M, then through the cylindrical lens C to the vibrating mirror V and thence to the ground glass screen or photographic plate $D\,G$. The mirror V vibrates so as to produce motion of translation of the point of light from D to G, the vibration being produced by the cam K operated by means of a small synchronous motor P. The apparatus is equipped with an electrical shutter which cuts off the return curve from G to D and further allows the taking of photographs.

The apparatus was connected in the following tests as in Figure 8. A non-inductive resistance R, consisting of incandescent lamps, was placed in series with the pressure coil, and the current coil was shunted across the non-inductive resistance R' through the series resistance R''.

This apparatus was tried on generators of known wave form, on non-inductive loads, on leading and lagging currents supplied to a synchronous converter, and found to give consistent results.

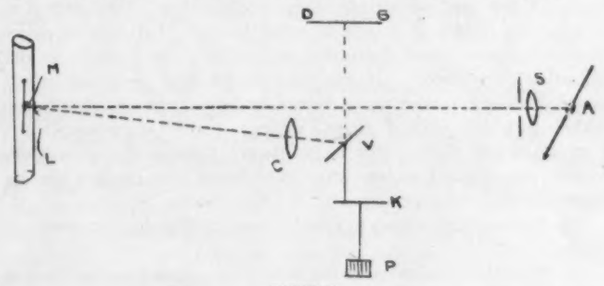


FIGURE 7.

During November, 1903, a large number of observations was made at Stanford University of the electromotive force waves from the lines of the Standard company, which supplies the university with light and power. It soon became apparent that the wave form varied considerably, the distortion varying apparently with the time of day, and hence probably with the load.

On November 28th, negatives were made at approximately thirty-minute intervals, beginning 3:00 p. m. and ending at 12:30 a. m. on November 29th. Tracings of these waves are shown in Figure 3, the time of taking being given at the left of each curve. They were taken across the terminals of one of two transformers arranged to supply a 120-volt, two-phase, synchronous converter, the synchronous converter being disconnected. The electromotive force varied between the limits of 88 and 103 volts during the test. Counting from the power house, this pressure was the result of four transformations, namely, from the generator at 2200 volts to 36,000 volts at Electra; from 36,000 to 6000 volts at Redwood substation, and also a phase transformation from three-phase to two-phase; from 6000 volts to 2300 at Stanford power house, and from 2300 volts to 90 volts in the transformer from which readings were taken. The original curve taken at 7:15 p. m. is reproduced in Figure 9. This curve was enlarged photographically, so that the length of one cycle was 2π inches when its equation was found to be

$$y = 1.718 \sin(\theta - 0^0\,20') + 0.063 \sin(3\theta + 177^0\,31') + 0.138 \sin(5\theta - 29^0\,15') + 0.028(7\theta - 90^0) + 0.001 \sin(9\theta - 90^0)$$

The positive and negative halves of the wave are not quite the same, due, probably, to a slight pumping of the synchronous motor operating the vibrating mirror. The above equation represents two half waves similar to the positive half wave. It will be noticed that the 12:30 wave approaches sine wave form.

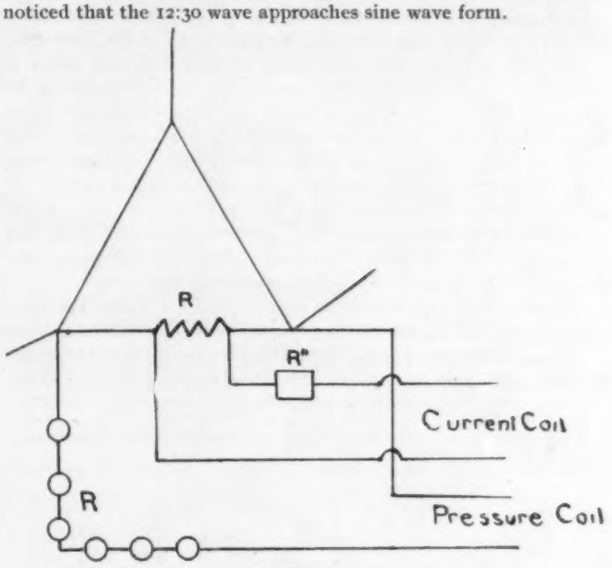


FIGURE 8

On December 31, 1903, the waves represented in Figure 2 were taken at San Jose. The pressure coil of the instrument was placed across the 2300-volt mains through lamps in series, and the current coil was shunted across a non-inductive resistance placed inside the $\triangle$. The distortion first appeared at 4:36, when the lighting load began to come on, the day being dark and rainy. This curve, together with one taken at 7:28, are reproduced in Figures 10 and 11. The wave taken at 7:28 was enlarged so that one wave length was 2π inches in length, and analyzed graphically for the first three harmonics. The equation is as follows:

$$y = 2.89 \sin(\theta - 17') + .0283 \sin(3\theta + 56^0\,58') + 0.22 \sin(5\theta + 180^0\,6')$$

The small motor operating the mirror pumped badly. The above equation shows a 9.7 per cent. third harmonic and a 7.6 per cent. fifth harmonic. Since synchronous motor load predominated the current leads by a small angle.

On January 16, 1904, the curves shown in Figure 1 were taken at Electra. The connections were the same as those at San Jose, the electromotive force being taken across the 2300-volt mains and the current being shunted across a non-inductive resistance inside the $\triangle$. The pressure waves show little variation through-

out the night. From 2:45 p. m. until 12 midnight two generators were in parallel. At 2:10 p. m. and at 2 a. m are shown the wave forms of a single generator. The original curves taken at 2:10 p. m., when the load was light, and at 7:41 p. m., when the peak occurred, are shown in Figures 12 and 13. Large leading current is shown in both. The average output at the peak is 3700 kilowatts, the line current 1150 amperes and the pressure 2280. The power factor by switchboard instruments would therefore be 80 per cent., indicating a lead of 37 degrees. The curve, Figure 13, shows greater lead than this. The calculated charging current for the bay circuit is about 30.3 amperes on the assumption of a sine wave with a corresponding generator current of 500 amperes. The line current at 2:10 p. m. was 550 amperes. The power factors figured from the curves and from instrument readings do not agree. The curves show a gradual change in lead angle from 2:10 to 7:41, while the wattmeters indicate only a small change in power factor. The wattmeters probably do not indicate correctly on the very large leading current.

In figure 14 are shown the waves of electromotive force and current supplying the mining circuits at 17,000 volts, the lagging induction motor load neutralizing the charging current.

The curves reproduced in Figure 4 were taken at the San Francisco substation on February 6th. The transformers, as before stated, are here Y-connected to the 4000-volt mains of the San Francisco Gas and Electric Company. The pressure coil was connected between the neutral and one line, the current coil being shunted across a non-inductive resistance, as in the preceding cases. The original curve reproduced in Figure 15 was taken at 7:40 p. m. The last wave taken at 1:30 is seen to be practically the generator wave as shown at 2:10, Figure 1. Although these observations were not taken simultaneously, load conditions were probably nearly the same for all of the four sets. The load curves also were much the same as those plotted for January 16th. It will be noticed that each set covers in point of time only about twelve hours of the day, each being started at about noon and continued until sine wave form reappeared. The electromotive force waves at all other times were practically sine waves.

Figures 2 and 4 are seen to be similar. Had a fourth set been taken at Redwood from the three-phase circuit, it would have been probably similar to 2 and 4. Pressures corresponding to the waves as given in Figures 1, 2, 3 and 4 are given in the following table:

Electra.	San Jose.	Stanford.	San Francisco.
2200	2200	98	2500
2200	2240	96	2500
2200	2240	103	2500
2200	2220	95	2500
2200	2220	92.5	2500
2200	2300	90	2520
2200	2340	88.5	2600
2300	2300	89	2600
2300	2300	89	2600
2300	2300	89	2600
2300	2320	90.5	2600
2280	2340	90	2590
2280	2320	95	2500
2280	2300	96	2500
2280	2220	94	2500
2280			
2280			
2280			
2200			
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2200			

While taking observations at San Jose there was considerable pulsation on the line, especially at 6:38, due to the generators of the San Francisco Gas and Electric Company, which were operating in parallel. The effect as observed on the ground glass screen of the instrument was a see-sawing of the two peaks of the wave—when the amplitude of one increased, that of the other diminished, and the reverse. This phenomenon suggested that perhaps the distortion was entirely due to the influence of the San Francisco generators. This assumption is, however, not borne out by Figure 16, taken at San Francisco with the generators disconnected. The wave form of the San Francisco generators is shown in Figure 17. A moving film attachment to the instrument would give much valuable information on surging caused by switching, short circuits, or pulsations due to any cause.

The effect of the variable wave form in low tension circuits, as shown in Figure 3, on the accuracy of an induction meter was investigated and found to be negligible. It is, however, probable that the accuracy would be considerably affected on wave forms like those shown in Figures 2 and 4, depending on the amplitude and phase relations of the harmonics.

The variation of the core losses has not yet been determined. The ratio of maximum to virtual in curve 7:28, San Jose, is 1.4, and the ratio in curve taken at 11 p. m. is 1.55, indicating a 10 per cent. variation, and, therefore, a probable inverse variation in

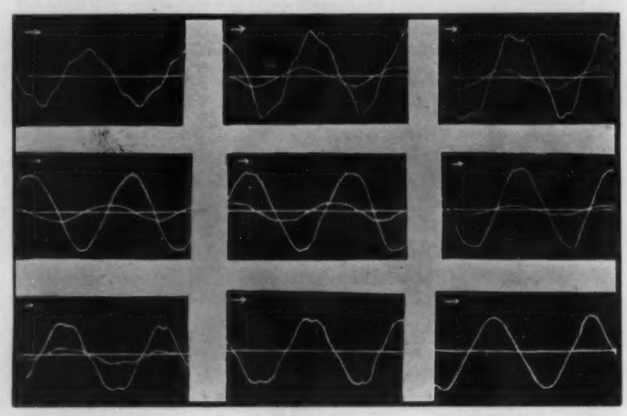


FIGURE 9. FIGURE 10. FIGURE 11.
FIGURE 12. FIGURE 13. FIGURE 14.
FIGURE 15. FIGURE 16. FIGURE 17.

core loss. Maximum pressures as derived either from spark determination or from transformer ratio may also be considerably in error.

There is reason to believe that greater variations occur on long lines which are more fully loaded. The large wattless currents sometimes observed in synchronous motors and synchronous converters with fields adjusted for minimum current are probably due to wave form differences. These, together with pulsation difficulties, could be satisfactorily observed with a moving film oscillograph.

Where so many disturbing elements are present, it is difficult to select the predominating cause of distortion. Doubtless it is due to the influence of synchronous motors of dissimilar wave form, to alternators of dissimilar wave form, and largely to the pulsation of reactance. It has been shown that resistance interposed between a sine wave source and the primary of a transformer to which normal virtual voltage is applied causes distortion in the secondary. Similarly, Figure 1 shows the generators to give practically true sine wave at all times, and Figures 2 and 4 show the distortion to vary with the line "drop."*

The following summary of conclusions is suggested for consideration:

1. Advisability of substituting induction motors for synchronous motors on lines with large charging current, and the use of the latter as synchronous compensators properly distributed.

2. The impossibility of designing machines to suit all wave forms.

3. The oscillograph offers the best means of studying variations in wave form, amplitude factor, surgings, pumping, etc.

*See *Electrical World and Engineer*, August 8, 1903.

4. The best form of oscillograph for this work is the moving film or falling plate type, without the synchronous motor attachment. It should be insulated for use on high pressures, and fitted with non-inductive metallic resistances.

5. The variation in amplitude factor in a long line may be considerable.

6. Core loss variation may also be considerable.

7. The charging current may differ from that calculated on the assumption of a sine law.

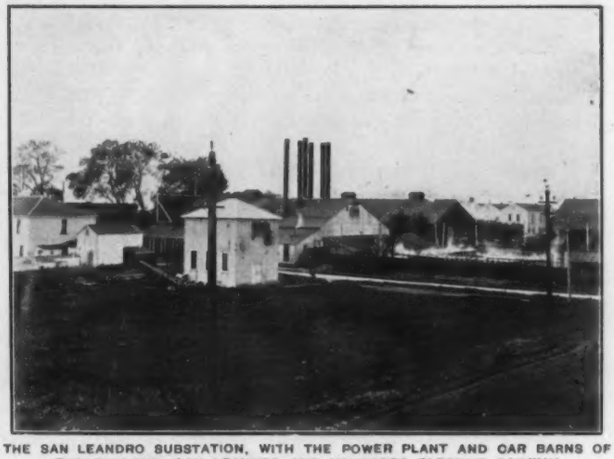
8. Assumption of sine wave form on long lines and applied to insulator and insulation testing may lead to error.

9. Variation of wave form partly due to distorting effect of hysteresis loop under different conditions of load.

The writer wishes to acknowledge the courtesy of Professor J. N. Le Conte in allowing the use of his harmonic analyser, and for valuable assistance in its use. The writer also wishes to acknowledge the assistance of Mr. Joseph Mini, Jr., whose practical experience rendered his services particularly efficient.

LIGHTNING STRIKES IN TWO PLACES.

LIGHTNING is of such infrequent occurrence within the greater portion of California that its advent to an extent that portends damage to aerial electrical lines becomes a noted event. And for lines to be disabled by lightning works hard the memory of that perennial patriot—the "oldest inhabitant"—who has studied the weather from time immemorial. Nevertheless the middle of April was characterized by thunder storms which extended over the northern part of the State and



THE SAN LEANDRO SUBSTATION, WITH THE POWER PLANT AND CAR BARNS OF THE OAKLAND, SAN LEANDRO AND HAYWARDS ELECTRIC RAILWAY CONSOLIDATED IN THE REAR

which did material damage to two substations. The Balakalala substation of the Northern California Power Company, in Shasta County, suffered to the extent of losing its lightning arrester equipment, but fortunately causing no cessation of service, and almost simultaneously the 4000-volt secondary distribution circuits of the Suburban Electric Light Company, of San Leandro, were struck by lightning, which entered the substation at Elmhurst, blew all the fuses and burned out an ammeter, incidentally wrecking such incandescent lamps as were burning on the circuits at the time—3 o'clock in the afternoon. Aside from the cost of lamp renewals, which the consumers paid for, the company's loss is stated to be less than $20, and service was restored after a brief interruption.

The Elmhurst substation is one of the two substations maintained by the Suburban Electric Light Company, the other one being at Mission San Jose, and as the secondary circuits of the former were not provided with lightning arresters, the damage may be largely ascribed to their omission. Both these substations take power from the high tension standard line of the California Gas and Electric Corporation, which fortunately was skipped.

It is indeed a singular coincidence that the Balakalala and Elmhurst substations, situated as they are more than 300 miles apart and on entirely different and separate transmission systems, should each receive a stroke by lightning at practically the same moment.

THE COST OF STEAM AND GAS POWER.*

BY J. R. BIBBINS.

THE accompanying chart is intended to furnish general data upon the comparative cost of fuel for steam and gas power plants under various conditions and efficiencies. The upper section determines cost of power directly; the lower is a conversion chart for determining the production cost of gas in the gas generating plant.

Referring to the upper right hand quadrant, the diagonals represent the gross coal consumption of a steam plant in terms of useful output. A trial setting is indicated by the dotted line *A*. For example, with coal at $4 per ton and a gross station economy of five pounds coal per kilowatt-hour, the cost of power at the switchboard is 1 per cent. per kilowatt-hour. The economy chosen is rather low for small plants, but represents a fair average

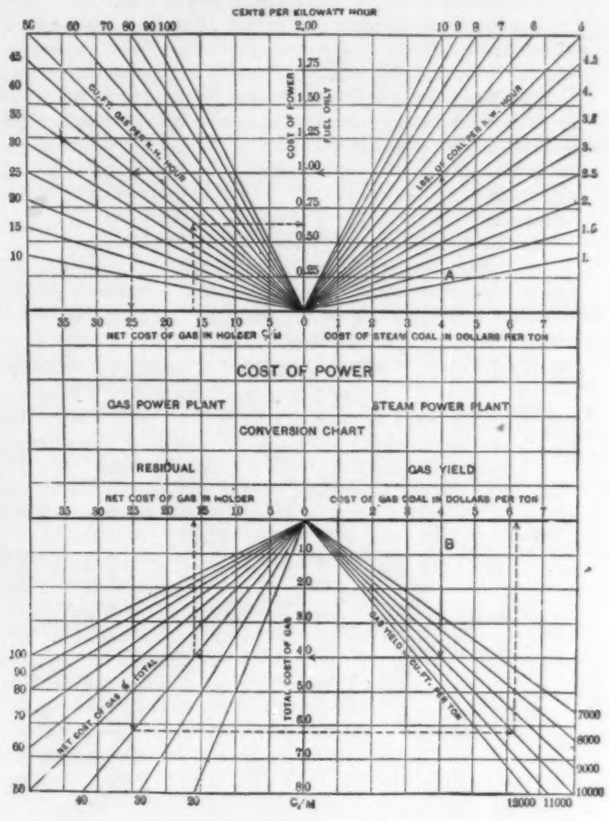


CHART SHOWING RELATION BETWEEN COST OF STEAM AND GAS POWER

for moderate sized condensing plants of several thousand horsepower capacity.

In the upper left hand quadrant, the diagonals represent in a similar manner gross economy of a gas power station. Following out the trial setting with gas at 25 cents per 1000 cubic feet and a gross economy of forty cubic feet of gas per kilowatt-hour, the cost of gas power at the switchboard is 1 cent per kilowatt-hour. This economy is approximately the average of the plants on exhibit. With plants of considerable size much better results could be realized.

In the lower right hand quadrant the diagonals represent the gas yield per ton of coal gasified. The usual average is 10,000

*From *Power*, March, 1904.

cubic feet per ton. With cost at $4 per ton, the total cost of gas at the above yield is 40 cents per 1000 cubic feet.

As a considerable saving is, however, derived from the sale of residuals, the actual cost of gas in holder is obtained by deducting the equivalent percentage of cost.

In the lower left hand quadrant the ratio of net to gross cost is represented by diagonals. Thus if the sale of residuals amounted to 60 per cent. of the cost of coal, with gas at 40 cents per 1000 gross, the net cost in holder is 16 cents, at which rate it should be charged to the engine for comparative results.

Usually residuals secure greater return than 60 per cent., particularly in locations where coke is high, and it frequently occurs that the entire cost of fuel is returned. In this case, therefore, the fuel cost of gas power would be nothing.

Two sample settings worked out on the chart indicate its use:

1. At a given price for steam coal, how much can works afford to pay for gas coal for the same cost of power?

Assumptions:

Steam coal, $4 per ton.
Steam station economy, 5 pounds per kilowatt-hour.
Gas station economy, 40 cubic feet per kilowatt-hour.
Ratio net cost of gas to gross cost, 40 per cent.
Gas yield, 10,000 cubic feet per ton.

Solution:

Gas coal, $6.20 per ton.
Cost of power, 1 cent per kilowatt-hour.

2. With steam and gas coal at the same figure, what are the comparative costs of power?

Assumptions:

As above.

Solution:

Steam plant, 1 cent per kilowatt hour.
Gas plant, 0.675 cent per kilowatt-hour.

The chart may of course be applied to any individual case by making the corresponding assumptions.

ON DRYING-OUT HIGH-TENSION TRANSFORMERS*.

BY J. S. PECK.

THERE are three methods of drying-out high-tension transformers, namely, by the use of internal heat, external heat and internal and external heat combined:

In applying the first-mentioned method the transformer should be placed, if possible, in its case, though this is not essential, as it may be left in its shipping case or even placed on the floor of a dry room. If dried out in a case the cover should be removed to give free circulation of air. The low-tension winding should be short circuited, and a sufficient voltage impressed on the high-tension winding to circulate the desired current through the coils. For large transformers (250 to 500 kilowatt) approximately one-fifth normal full-load current will be sufficient to raise and maintain the coils at the desired temperature, viz., approximately 90 degrees Centigrade (194 Fahrenheit). For small transformers a somewhat larger current will be required. For circulating this current through the windings from 1 per cent. to 2 per cent. of the normal high-tension voltage at normal frequency will be required; thus, for a 10,000-volt transformer from 100 to 200 volts is necessary. For controlling the current a rheostat may be placed in series with a high-tension winding.

In applying the external heat method, the transformer should be placed in a wooden box, the packing case answering the purpose very well. An opening should be made near the bottom and another at the top of the box to permit a circulation of air, and also to serve as a means of controlling the temperature of the air inside the box. The heat may be applied by circulating current through the resistances. The iron grid form is frequently most suitable, placed at the bottom of the box. It should be applied at such a rate that the transformer coils will be maintained at approximately 90 degrees Centigrade (194 Fahrenheit). Care should be taken to protect the transformer from direct radiation from the heaters. Care must also be taken to see that there is no inflammable material near the heaters which may catch fire. This method of drying out has an advantage over the method outlined in (*a*), in that direct current may be used for heating.

Instead of placing the heater inside, the box containing the transformer may be placed outside and the heat carried into the box through a suitable pipe. Where this plan is used the heat may be generated by the direct combustion of gas, coal or wood, but none of the products of combustion should be allowed to enter the box containing the transformer. Heating by direct combustion is not advised except in cases where electric current is not available.

In the internal and external heat methods the transformer should be placed in a wooden box, as in the above method, and external heat applied, while at the same time a small amount of current is circulated through the transformer windings. The method of circulating the current should be the same as given in the first method discussed, and the method of applying the external heat the same as given in the second method. The current should, of course, be considerably less than when no external heat is used, the value being determined, to a certain extent, by the amount of external heat applied. This method is used occasionally where direct current only is available, a certain amount of current being passed through the high-tension winding only, as the low-tension winding is ordinarily wound for so heavy a current that it cannot be obtained economically from a direct-current circuit.

The length of time the drying-out should be continued will depend largely upon the condition in which the transformer is received, and unless in very bad shape a week's run should be sufficient to put the transformer in good condition. In certain cases, however, it has been found necessary to continue the run for a somewhat longer time.

It will be found that when the current is first applied and the transformer heats up, the insulation resistance will drop very rapidly, until the desired temperature is reached; then, as this temperature is maintained constant, the resistance will gradually increase. It will also be found that variations from a constant temperature will cause wide changes in resistance. Resistance readings should be made every few hours and the drying continued until the resistance no longer increases, or increases at a very slow rate.

Certain precautions are to be observed in the work. In order to dry out the transformer, it is necessary to maintain it at a temperature which approaches the point where fibrous materials deteriorate. Great care must, therefore, be observed during the whole period of drying out to see that the temperature does not reach a value much in excess of 90 degrees Centigrade.

For measuring the temperature of the transformer coils, several thermometers should be used. These should be placed well in between the coils, near the top of the transformer, and screened from air currents, so that they will indicate the maximum temperature of the windings. As the temperature will rise quite rapidly at first, it is necessary to watch the thermometers carefully to see that the maximum allowable temperature is not exceeded.

As the transformer is soaked with oil, on account of the test which it receives in the works, the material is in an inflammable condition, and while hot it may be ignited very easily by a very small arc, or from a blaze of any kind. Before beginning the drying out, it is well to have some chemical extinguisher, or at least a supply of sand, at hand, which may be used in case of necessity. In general, it is not safe to attempt the drying out of transformers unless constant attention can be given to them.

*Abstracted from a contribution to the *Electric Club Journal*, Volume I, page 133, 1904.

THE BATH ELECTRIC TRAMWAY.

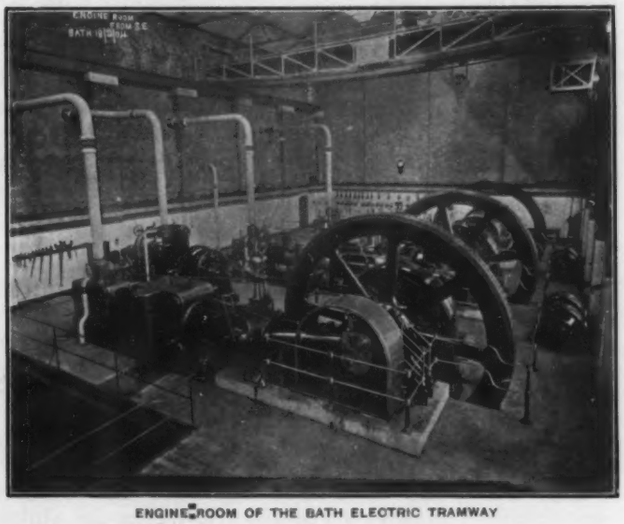
BATH, an ancient Roman city situated on the river Avon, twelve miles from Bristol, England, saw the last of its dingy horse cars in July, 1902, when their franchises expired. No sooner were the people obliged to find other means of getting about than the subject of electric traction was brought up, and now Bath is no more an ancient city in so far as electric traction is concerned. The promotors of the scheme are Messrs.

Hammond and Butters, both of San Francisco, and Leobold Hirsch, of London. H. A. Butters, one of the directors, is also a director of the Geneva Electric Tramway Company and the Mexico Tramway Company. The capital of the company is £250,000, of which sum £75,000 5 per cent. cumulative preference shares have been issued, together with £125,000 preferred ordinary, leaving £30,000 deferred ordinary shares unissued.

The company's prospects are as follows: Thirty cars running 100 miles daily would cover 1,000,000 miles per annum, and estimating the receipts at a shilling (24 cents) per car-mile, would give £50 per annum. The construction costs are estimated at £25,000, interest and sinking fund on £250,000 would be about £15,000, leaving about £10,000 in yearly disbursements to the stockholders.

Ground was broken for the foundations of the main building in May, 1903, and the lines were opened to the public during the first week of January, 1904, making it an exceedingly rapid piece of engineering construction. Many difficulties were to be overcome. As the site is next to the river, the existing retaining wall was found to be insufficient to build upon and had to be rebuilt, and in some places the foundations for walls and engines were carried down to a depth of thirty feet.

The system comprises in all about sixteen miles of single track, the standard gauge (4 feet 8½ inches) ninety-pound rail, in



ENGINE ROOM OF THE BATH ELECTRIC TRAMWAY

forty-five-foot lengths, being used throughout. They are set on six inches of cement floating, with the flanges of the rail embedded in the same material, the balance being filled in with wood paving or granite setts. "Crown" type 4/0 cross-bonds are placed every thirty-three yards, these being furnished by the American Steel and Wire Company. The points and crossings were supplied by the Lorain Steel Company and Hadfields.

The overhead trolley wire is 2/0 B. & S. gauge, supported from brackets on side poles or span wires as the existing conditions called for. The poles are of steel, in three sections, and stand twenty-four feet above ground. Stranded steel galvanized guard wires are used, these being grounded through the poles. The contract for the cable work was awarded the British Insulated and Helsby Cable Company (Ltd.), which supplied in the neighborhood of eight miles of paper insulated and lead covered cable.

The plant is designed for the operation of forty cars, although but thirty are in use at present. Of these four are single and twenty-six are double-deck cars, the latter being a type generally adopted in England. The overall lengths are twenty-eight and twenty-seven feet respectively. The trucks are of a type known as "S. B. 60, four-wheel," having wheel bases of six feet. They were supplied by Milnes & Co., who also had the contract for the car bodies. Each car is equipped with two 49 type B, thirty horsepower, Westinghouse motors, with No. 90 controllers and magnetic brakes.

The grades on the line, which run as high as 1 in 11, have fully demonstrated the efficiency of the Westinghouse magnetic brake, which was approved by the Board of Trade after some very severe tests, such as removing the trolley from the wire while the car, heavily laden with passengers, was descending a gradient of 1 in 11. Under this test the car was brought to a dead stop within half its length.

The power house is situated on Walcot Street, and contains a boiler room 90 feet 6 inches by 49 feet, an engine room 93 feet by 51 feet 3 inches, and a car shed 125 feet by 82 feet. The repair shop is underneath the far end of the car shed, and has a floor space of 82 feet by 34 feet 6 inches, while the company's offices are situated in the front, over the entrance to the car shed. The whole building is of bricked in steel construction, a style of building mostly adopted by the British Westinghouse Company, to which the contract was let. The steam generating plant consists of three Babcock & Wilcox boilers, having an aggregate heating surface of 9420 square feet. The normal and maximum evaporation of water per hour per boiler is 11,000 to 13,000 pounds, with steam at 160 pounds per square inch.

The economizer is of the Claycross type, the scrapers of which are driven by a Westinghouse motor. Blake & Knowles electric driven and a Hall steam driven feed pump are used. The Wheeler Condenser and Engineering Company supplied the two surface condensers, while the air and circulating pumps are also of their make. A rather new feature as regards English practice in connection with the steam supply is the Holly gravity return installation, which has been included. The water softeners and purifier is by Mason, Scott & Co. Screw coal conveyors take the coal direct from the railway wagons to the bins, which have a capacity of twenty-five tons.

All the structural steel work, including a 140-foot self-supporting steel stack, was erected by John Lysaght (Ltd.), who were sub-contractors to the British Westinghouse Company. The stack has a diameter of thirteen feet six inches at the base and seven feet at the top under the cap, and is lined with brick throughout.

In the engine room are three 320 horsepower, horizontal, tandem, compound, condensing engines, fifteen and thirty by thirty-six, supplied and erected by Yates & Them. They are each direct-connected to a 200-kilowatt, 500–550-volt, eight-pole, direct current, Westinghouse generator, the full load current being 365 amperes. As an auxiliary to the traction load and also for lighting purposes, a seventy-five-kilowatt, direct-connected Westinghouse engine and generator has been installed. The set is one of the company's standards, the speed being 300 revolutions per minute, and the generator a four-pole machine. All the machines are designed for an overload of 25 per cent. for half an hour and to carry a momentary overlaad of 50 per cent. without injurious heating or sparking. The switchboard is a standard Westinghouse railway type, made up of thirteen panels in angle-iron frames. The two boosters are also of Westinghouse make, and are of fifteen kilowatts each. The overhead traveling crane which spans the engine room is operated by three Westinghouse motors. The car shed has eight tracks running the full length, each track containing an inspection pit. Kinnear rolling shutters will be used at the car shed entrance.

Great credit is due the management and staff of the British Westinghouse Company for the able manner in which the erection of the building and installation of the electrical machinery, together with all the accessories, was carried out, and all in the incredibly short space of time, considering the difficulties encountered, of eight months. This being but one of the many similar, but larger contracts which the company has in hand, allows for the systematic buying and handling of each item, thereby making a great saving, mainly in time.

In conclusion the writer may say that within the last few months a great number of Parliamentary obstacles have been removed from the path of the light railway, so that the prediction is made that the present generation will be able, before many years have passed, to travel from London to Liverpool by an all-electric railway.

The Journal of ELECTRICITY POWER and GAS
DEVOTED TO THE CONVERSION, TRANSMISSION and DISTRIBUTION OF ENERGY.

PUBLISHED MONTHLY BY
The Journal of Electricity Publishing Company
Room 532, Rialto Building, San Francisco, Cal.
Telephone Main 1264.

Official Organ of the Pacific Coast Electric Transmission Association.

Yearly subscription: Domestic, $2.00; Foreign, $2.50; Single Copies, 25 cents.
Subscriptions can not be begun with back numbers.
Manuscripts submitted must be accompanied by postage to insure return.

ADDRESS ALL COMMUNICATIONS AND MAKE ALL REMITTANCES PAYABLE TO THE JOURNAL OF ELECTRICITY PUBLISHING COMPANY.

This paper is a member of the National Trade Press Association.

Entered as second-class matter at the San Francisco Post Office, August 15, 1899.
Entered as *The Electrical Journal*, July, 1895. Entry changed to *The Journal of Electricity*, September, 1895.

VOLUME XIV JUNE, 1904 NUMBER 6

EDITORIAL.

THE EVENTS OF THE YEAR

As forecasted in these columns last month, the Executive Committee of the Pacific Coast Electric Transmission Association has decided that its Eighth Annual Convention shall be held in Monterey. This action was determined upon after the receipt of a cordial invitation extended to the Association by the Monterey Chamber of Commerce to hold the convention at that old historic town.

The selection of Monterey as the convention city for 1904 was an act which is to be commended from every standpoint. Experience has given every warrant for the emphatic conviction that San Francisco is most decidedly not the place to hold the annual gathering of the transmission interests, if the welfare of the Association is to be regarded. People will come here to attend the convention, but their actual attendance will be only ostensible, and at best they will give the business of the Association only divided attention. Why this is true is not hard to discern. San Francisco is the business emporium of the Pacific States, and when once the transmission man—or any man of business, in fact—enters its gates, he has an hundred and one things on his mind to take care of, his time is unquestionably limited, his business *must* be attended to whether or no, with the result that convention matters, perforce, go by the boards. The experience of the Cliff House and Palace Hotel conventions gave ample demonstration of this, and Tamalpais and San Rafael were nearly as bad, for they both are within short distances of San Francisco, so that "intended attendance to the convention" was proved to mean a trip to San Francisco as a reality and a momentary call at Tamalpais or San Rafael as a courtesy. San Jose was infinitely better than these places, for despite its score or so of trains daily to San Francisco, it was less accessible to the metropolis. And of all its conventions, the Transmission Association has never seen a better one than that held at San Jose in 1901.

Old Monterey possesses charms of a distinctive character, and their charms lend themselves with utmost grace to make the place perfection in the eyes of the convention delegate. Its climate is ever incomparably fine, its new hotel—The Monterey—is a gem of exquisite perfection, its citizens are progressive to the point of praiseworthy aggeession, and its beautiful environs will alone afford a week of matchless entertainment and recreation. It is near enough to San Francisco to debar none from attending the convention, yet far enough to keep Smith, Brown, Jones & Co. from forever running out of the hall to see why in thunder that last carload of machinery hasn't yet left the San Francisco yards.

A wisdom born of experience is, then, directly responsible for the determination of the Executive Committee to hold the convention outside of San Francisco, and in selecting Old Monterey it has chosen a most fitting place. No convention heretofore held has had more time devoted to its preliminary arrangements than the forthcoming one—full particulars concerning which will be found in the leading article of this issue—and though "brown October ale" is not to be hoped for in the midst of June, probably some suitable substitute therefor may be found by the good fellows who will attend it. Not that conviviality is to be expected—that never occurs—but congeniality, good cheer, a most cordial welcome, and, above all, a harvest of profitable discussion may be counted upon as a certainty. Indeed, of all Transmission gatherings, the Monterey convention is destined to be the top-notcher.

The second event of importance during the coming summer rests in the Twelfth Annual Meeting of the Pacific Coast Gas Association, which will be held in the city of San Francisco on Tuesday and Wednesday, July 18th and 19th, 1904, and will be called to order at 10 a. m., Tuesday, by W. A. Aldrich, president. The place of meeting will be the Assembly Hall of the Mechanics Library, situated on Post Street, between Montgomery and Kearny streets. The annual meeting of the Board of Directors will be held on Monday, July 17, 1904, at 8 o'clock p. m., at the office of the Secretary, 617 Rialto Building, corner New Montgomery and Mission streets, San Francisco.

The following is the list of papers to be presented during the meeting: President's Address, W. A. Aldrich; "Benefits of Consolidation," Jno. Martin; "Some Practical Observations on the Flow of Gas in Pipes," L. P. Lowe; "Auld Lang Syne," T. R. Parker; "Notes Regarding California Petroleum," P. W. Prutzman; "Pressure Points," E. C. Jones; "From a Consumer's Standpoint," John A. Britton; "Effective Steam Plants for Gas Manufacture," C. H. Pennoyer; "American vs. English Gas Cooking Stoves," A. S. Main, Glasgow, Scotland, C. S. Barbour, London, England, H. Tren-

kamp, Cleveland, U. S. A.; "Wrinkles," R. P. Valentine; "Experiences," Geo. S. Colquhoun; "Novelties," Geo. H. Hollidge; "Question Box."

The annual banquet will be held on Wednesday evening, July 19th, at 7 p. m., and the annual outing for the members, their families and friends will go by special train to Alum Rock, in Santa Clara County, on Thursday, July 20th, particulars of which will be announced at the meeting.

Arrangements have been made for a lecture on "Radium," to be given on Tuesday evening, July 18th, 1904, by Professor Edward Booth, of the University of California, to which members and their families will be admitted.

THE BATTLE WITH THE ELEMENTS.

It has remained for a writer in a popular weekly periodical* to point out that "the thing we call civilization seems to be an incessant battle with Nature. As soon as man had shed his tail, covered his nakedness and made a fire, he began to prod the earth and whip the waters of the earth to make them serve him. For a countless period of time Nature works in her indominable way, putting a portion of the earth under a certain flora and bringing from the uttermost parts animals that thrive thereon; the balance between the needs of the plants and the requirements seems perfect, and this perfection evidently reflects some definite and understandable purpose of direction in things. Of a sudden man comes, with his fire, and his clothes, and his steel tools, and his own purpose, and his own direction. In a year, or at most a decade, Nature surrenders; the wilderness becomes a garden, growing plants different from those that Nature put there, fattening animals that drive out those which Nature brought from afar and bred there, and making the dessert to bloom, or the forest to shrivel away. And the aspect of things changes with another purpose seemingly as indominable as that of unfettered Nature, but with a foresight and wisdom in using Nature's tricks to conquer Nature's wildernesses that reveals a kinship between the two forces—the mind of man and the 'way of the Lord.'"

Each channel of industry, each branch of science, each field of engineering—each form of civilization, in brief, may lay just claim to its quota of credit in this campaign against the strongholds of Nature; but of all, none wear laurels of greater triumph than the electrician, who, in taming the thunderbolt, has wrought miracles that give to man his most invincible weapons. Power conquers all, be it the muscle behind the axe or the piston before the steam; and where in all the world is power found in a more obedient, more flexible, more universally applicable form than that given through the medium of electricity.

The writer quoted is too politic to be partisan; but in discussing the enormous development now taking place in that section of the country perhaps best defined as the Pacific Northwest, he goes far toward substantiating the assertions just made. We may review that which he has written with profit.

*William Allen White in *The Saturday Evening Post*, of May 21, 1904.

One-fourth of Europe that wears its shirt-tails properly tucked in could be put in this territory, and yet excepting a few cases, a few cities and a few garden spots it is as the floods that followed the glaciers left it. For considerably over a generation this waste place has been reasonably familiar to men; it has been crossed by three railroads and penetrated by several others. Its various climates are pretty well recorded and its mineral resources have been guessed at with something like accuracy. The power of its rivers have been gauged and the wonders waters would work when turned upon the soil have been known both by precept and by example. But the Northwest has been the land of tomorrow—the land that would always be there when the world got ready for it. And now tomorrow has come to this land, and the day of waiting has closed. The prosperity of the seven fat years last past has piled up capital for investment, and the capital has sought the point of least resistance for its outlet. For this Northwest is essentially a country that must be opened by capital.

It is one of the few American settlements that will be made not by the individual but by groups of individuals; for three industrial forces, each requiring considerable capital for operation even in a small way, will be the visible means of support of the Northwest. They are irrigation, electric power and mining. When a man's farm is on a big ditch that supplies water to a dozen other farms, and when his shop is on a wire that supplies a score of other shops, and his mine is remote from the main highways of commerce, dependent absolutely on a State wagon road or the spur of a railway that he and a dozen mine owners have 'chipped in" to build, he loses that sense of freedom and unrestrained independence that he gets on a Kansas farm where his only partner is Providence. But with the loss of independence comes the feeling of security. The weather of Providence is capricious; the water in an irrigation ditch is certain. About the best Kansas land is worth $100 an acre; and irrigated land in the desert begins at that figure without improvements and ranges upward to $1000 an acre. And so the law of compensation works through all the world.

The extent of the irrigation movement in the Northwest is appreciated when one learns that four companies in three States are building ditches to bring nearly a millon acres under cultivation within the coming year—the Big Horn Irrigation Company, and one financed by W. F. Cody (Buffalo Bill) in Wyoming, the Twin Falls Irrigation Company in Idaho, and the Washington Irrigation Company. A score of smaller projects will reclaim half a million acres in this territory, and within the next two years the Government will have $10,000,000 to spend on lands now under survey in the States of Idaho, Wyoming, Montana, Washington and Oregon. There is no lack of water in this territory. The mountains are

snow-capped, and the desert rivers flow the year round. The Snake River, the Yellowstone, the Columbia and their tributaries carry water enough to irrigate milions of acres, and some day this water will be used. It is within the bounds of reason to predict that during the next ten years the waters of these streams will be covering an agricultural territory richer and more productive than that of all New England. For when an irrigated acre is reclaimed it is a full acre. A quarter section is 160 acres, every inch of which is good for two and often three crops a year. There is no waste land and no such thing as a crop failure. In the lava dust soil of Idaho, remote from city markets, there are hundreds of fruit farms yielding crops that establish an average price of $200 an acre for the land. In the Wenatchee Valley in Washington, where the cities of Portland, Seattle and Tacoma furnish a lively market, land sells from $250 to $950 an acre, according to the improvements it bears in the way of trees and perennial crops established.

The Twin Falls ditch is a representative Idaho irrigation scheme. Water is taken from the Snake River at the town of Milner, where the river chokes between two islands. Here a great dam, the third largest in the world, and the largest in America, has been thrown across the stream. The dam is building by electric power generated by the river, and the Snake is literally damming herself. The water thus confined is turned into a ditch on the south side of the stream. This ditch is ten feet deep, 125 feet wide at the top, and over sixty miles long. A similar ditch seventeen miles long runs from the dam on the north side of the Snake, and the two ditches will water 270,000 acres. The land is divided into quarter sections which are sold for $3.50 an acre in cash and $21.50 in long time payments. These are the terms of a contract made by the constructing company with the State of Idado under a national irrigation law called the Cary Act. The water right belongs to the land, as 160 shares of stock in the company owning the ditch and the dam go with each quarter section sold. When the land is all sold the stock in the irrigation company will belong to the settlers, who will operate the ditch as any other stock company. There can be no debts against the ditch and the dam. Two and one-half million dollars is going into this work, and enough water will be turned into the big ditch this spring to cover 80,000 acres, and practically all this land will be sold and occupied by the time it comes under the ditch. It should be added that the engineers' plans provide for a storage lake to hold flood water. This will be eight miles wide thirteen miles long and thirty feet deep.

One of the wonders of irrigation in the West is a California plant which uses the water three times. It is first transformed from a waterfall into electric power, and then runs into a ditch that waters a high plateau. The electric power pumps up the seepage from wells on a lower bench of land, and uses it again to cover the land on that level; and 50 per cent. of the water taken out of the first ditch reaches the river again. The Yankee will do more wonders with water in the next generation than he has done with land. And one of these great things will be the development of electric power. On the Snake River alone there are now under consideration, and in several cases under construction, power projects which experts have declared will produce half a million horsepower at low water and will not be obstructed or thrown out of operation by floating ice in winter. Near the city of Tacoma surveys have been made and work is progressing to produce over 150,000 horsepower from the waterfalls on the near-by mountains. Just as much power may be developed near Portland and Seattle. Almost every city or town in all the Northwest has at its door more power than it can use. Literally, millions of dollars are being invested in these power schemes.

The Shoshone Power Company is a project that is typical of the best power concerns along the Snake River. It is building and has practically completed a tunnel nineteen feet in diameter, with a fall of 200 feet in 400 of length. It is estimated that this will generate 20,000 horsepower. The company has ten adjacent tunnel sites, each of which will develop this amount of power, at Shoshone Falls; at Twin Falls, a few miles above Shoshone Falls, the company has a location which will develop 100,000 horsepower, and below Shoshone, at Twin Lakes, the Augur Falls power rights are owned by the same company, and Augur Falls, though a comparatively small affair, will develop 25,000 horsepower. These three falls are now twenty-five miles from a railroad. They are remote from any settlements; but when the water is turned into the Twin Falls ditch this spring 5000 homeseekers who have bought land of the Twin Falls Company will move into the country, and capital is only waiting for the water to flow into the ditch to call the town of Twin Falls into being; in two years what is now a dreary stretch of sagebrush will be involved in a paving scandal, and the bond election for the beet sugar factory will be boiling hot. But Twin Falls and the Twin Falls country will use only a small part of the Shoshone Company's power. Much of it will go to Salt Lake and to Tonopah, the new Nevada gold mining camp (which has no water and is short of power), and some of it will be sent northward into the Saw Tooth Mountains. The wires may go north or south, but they cannot follow the river, for every hundred miles they would encounter other power systems just as great. There is a series of springs a score or so of miles down the river, between Shoshone and Glenn's Ferry, which competent hydraulic engineers have estimated will develop 300,000 horsepower, and at almost every ferrying place along the Snake River it is possible to develop enough electricity to run a good sized inland town. The promoters of these power companies are country bankers and fruit growers and men who do not know the watery ways of Wall Street, and the capitalization of these companies is rarely larger than a sum on which the plant may earn a small interest. If pools and combinations continue in fashion, some day a high-hatted promotor may wander out this way and unite a hundred or so of these plants

into one company, put their stock into a merger, and make enough money to grow three double chins and moralize on the virtues of thrift and industry. But now these power plants are simple enterprises which have their roots only in the needs of the communities near them, and not in the greed of gentlemen who sugar-coat their grand larceny with the patter of high finance.

But whether or not the stock gamblers manipulate these power plants that are building now, they will not seriously hamper the latent energy of the desert rivers and mountain waterfalls. When this energy is harnessed and transformed into power it will destroy the desert. Cities and men will fill the valleys and overrun the mountains. All that is worthy in American civilization will bloom and come to fruit here, but in its own way, and with sectional features as distinct as those of the South, the Middle West or New England. The feeling of commercial interest in one another, which is bound to come to people strung on a common ditch and on a common wire, is sure to show itself in character as the generations pass. It is interesting in this connection to know that when the Shoshone Falls Company's power plant, which is now far ahead of any other power undertaking in the desert, was first contemplated it was linked with the Twin Falls Irrigation Company, above mentioned, and the plan proposed was that with each quarter section of land sold to a settler the light and heat for his house and stables be furnished. The men who dreamed this dream lacked ability to raise the money for the two schemes combined, though each is now amply provided with funds. Some time this dream may be realized; it is within the range of probabilities; there is power enough on the Snake River to furnish light, heat and power for a million people.

PROGRESS IN STEAM TURBINE INTRODUCTION.

IN this age of unprecedented activity in the generation and utilization of large powers it is peculiarly gratifying to observe the confidence which the steam turbine is producing in the minds of engineers intrusted with the design and equipment of important properties. The replacement of the reciprocating engine is becoming particularly noticeable in large transportation systems, and it is a somewhat remarkable fact that in the planning of new systems and enlargement of old ones, steam turbines have been exclusively introduced.

It has been already announced that the immense power station of the Pennsylvania, New York and Long Island Railroad, and the Philadelphia Rapid Transit Subway system of Philadelphia are being equipped with steam turbines aggregating at the start 33,000 kilowatts capacity; but of more immediate interest is the fact that the Interborough Rapid Transit Company of New York and the Brooklyn Rapid Transit system have both adopted steam turbines of the Westinghouse-Parsons type for extensions in power. The equipment of these systems will be in units of 5500 kilowatts each, thus conforming to the precedent established by the Pennsylvania and Philadelphia systems in regard to the capacity of their largest main generating units. The Philadelphia Rapid Transit Company has also recently extended its original order for 16,500 kilowatts in Westinghouse-Parsons turbines by 6000 kilowatts in four units of 1500 kilowatts each.

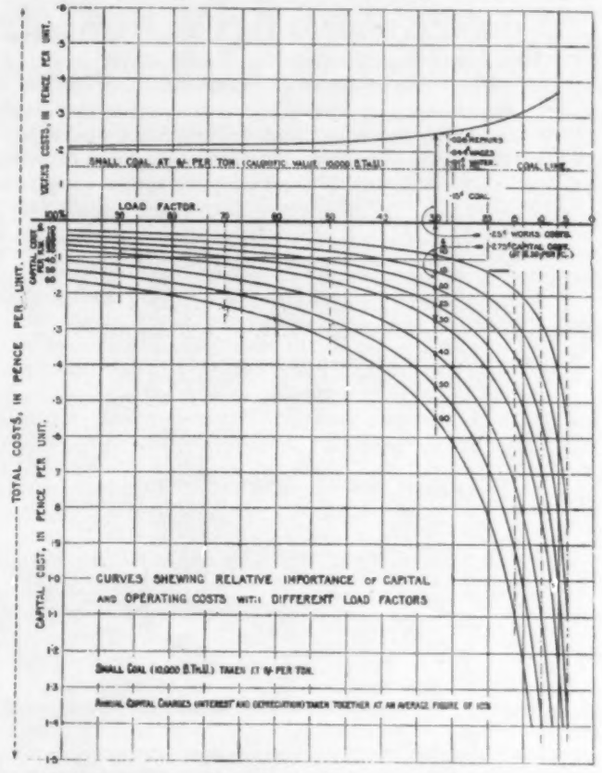
In the electric light and power field the activity in steam turbine introduction still increases. Two 1000-kilowatt Westinghouse-Parsons turbines will form the additional equipment to the present power system of the West Virginia Pulp and Paper Company of Piedmont, W. Va. The United Electric Light Company of Springfield, Mass., has contracted for a 1000-kilowatt Westinghouse-Parsons unit for their power station at Springfield. A contract has been recently closed with the Merchants' Light, Heat and Power Company of Indianapolis, Ind., for two 750-kilowatt Westinghouse-Parsons turbine units for general light and power service. The Iowa and Illinois Traction Company of Clinton, Ia., will shortly install two 400-kilowatt Westinghouse-Parsons turbine units for furnishing additional power to its present railway system.

An installation of peculiar interest, as being the first to be placed in service in American mining work, will be that of the Newhouse Mines and Smelter Company, which will install two 400-kilowatt Westinghouse-Parsons turbine units at its Cactus Mines, near Frisco, Utah. Turbines will furnish electric power for lighting the buildings and mines, and for all kinds of power throughout the entire property.

ON THE IMPORTANCE OF THE LOAD FACTOR*.

BY C. H. MERZ AND WILLIAM McCLELLAN.

IT is essential for the designer of electric power stations to keep before him as a main consideration the economy of production, which may be conveniently subdivided into running charges and capital costs. Early engineers, whether civil, mechanical or electrical, were justifiably content if the work for which they were responsible proved reliable, operating and capital



costs being minor considerations. The necessity for low operating costs was next fully recognized, so much so that this consideration was allowed to overrule all others, even that of reliability—certainly a backward step.

The fact that a project must work well and efficiently, and that it must do both these with a minimum of initial expenditure, is now realized as essential. No engineer can afford to disregard *low capital cost*, which is equivalent commercially to *low annual cost*. The importance of keeping the capital cost as low as possible, especially in the case of a power station, may be fully appre-

*Abstract of a serial on "Power Station Design," in *The Engineering Times*, London, May 5, 1904 (Volume LXIV, No. 1). Though the cost conditions which are discussed are those prevailing in England, the results indicated apply equally well in American practice.—THE EDITOR.

ciated by a careful consideration of its characteristics as referred to above. We do not think it is wide of the mark to suggest that 10 per cent. per annum should be considered a sinking fund in deciding whether to spend more money than is absolutely necessary on any particular section of the plant in a power station in order to secure lower running costs. In stating this we have specially in mind the liability of change in the generation of power, both in method and in the location of the power station.

The relative importance of capital cost and running cost may be seen at a glance for any particular values of either load factor, capital cost or running cost from the curves attached. From these curves it will be seen that a reduction of the capital outlay by £1 per kilowatt has a greater effect on the running costs than has a reduction of the coal bill by 6 per cent., on the basis of coal at 6 shillings per ton. This applies with a load factor as high as 30 per cent.; it is therefore evident that for lower load factors the question of limiting capital expenditures becomes of overwhelming importance, as compared with that of reducing running costs.

AN ELECTRICAL TRANSMISSION MEETING IN CHICAGO.

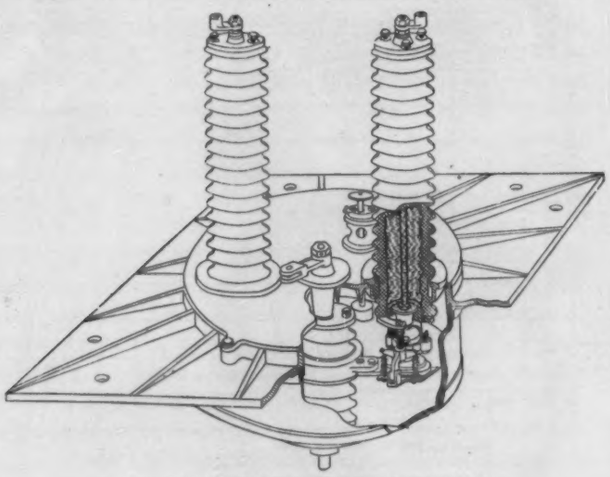
A MEETING of engineers and others interested in electrical transmission problems will be held in Chicago, probably at the rooms of the Western Society of Engineers, early in June. This convention, to which all interested in the subject are invited, is under the direction of the transmission committee of the American Institute of Electrical Engineers, which is composed of Ralph D. Mershon, 29 Broadway, New York (chairman), E. O. Blackwell of Schnectady, C. C. Chesney of Pittsfield, Mass., A. M. Hunt of San Francisco and P. M. Lincoln of Pittsburg. It is an outgrowth of the work of securing and classifying data of high-voltage transmission outlined by Mr. Mershon's committee, the first results of which were made public at the Niagara Falls convention of the Institute last year. The Chicago transmission committee consists of James Lyman, Monadnock Building (chairman), P. Junkersfeld and George A. Damon.

It is expected that over a hundred transmission men will attend the convention.

INDUSTRIAL

THE S.K.C. HIGH VOLTAGE OIL SWITCHES.

THE S.K.C. high voltage oil switches possess a number of distinguishing features which have been suggested by the extensive experience of its manufacturers, the Stanley Electric and Manufacturing Company, with high potentials. It is claimed that these switches are decidedly superior to those high voltage oil switches of the plunger type wherein the contacts are contained in very small chambers. The S.K.C. switches are so



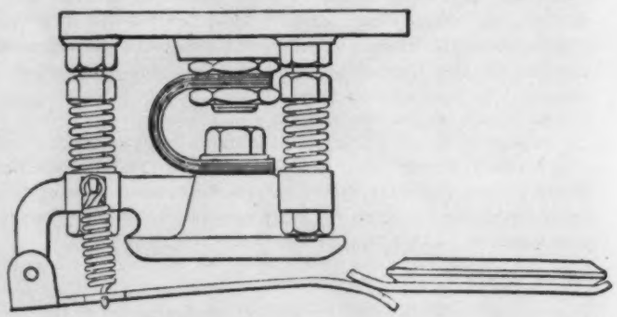
THE S.K.C. 60,000-VOLT OIL SWITCH

designed that the circuit is broken simultaneously at several points, thus distributing the resulting disturbance over a considerable area. Then, again, for potentials above 6600, the various contacts are arranged in the same horizontal plane, so that the disturbances resulting from the rupturing of the arc are distributed, rather than concentrated, as is the case where the contacts are one below the other. Another advantage of opening the contacts in a horizontal plane is that the arc tends to flare upwards, increasing its length and thereby securing a longer break than in the vertical type with the same separation of contacts. Furthermore, the contacts are located comparatively hear the surface of the oil, so that the gases resulting from the explosion are readily dissipated, and, by using comparatively large tanks and long breaks, the switch may be opened and closed many times before the oil is carbonized appreciably.

The principles of construction above outlined are embodied in the new S.K.C. 300-ampere, 60,000-volt, switch. A number of these have been installed as a part of the equipment of the high voltage transmission systems in the West, having been selected after prolonged competitive tests. The figure gives a good idea of the general construction of the switch. Each pole consists of, first, a cast iron top or mounting plate, on which are mounted the two terminal contact insulators, a bearing of liberal length for the driving shaft, and a combined gas vent and automatic oil level indicator; and secondly, a tank filled with oil in which are immersed the contacts suitably insulated. The insulators are of porcelain, made in the form of corrugated cylinders. The center insulator carrying the contact blades is entirely immersed in oil. The two terminal insulators are partly filled with and have their lower ends immersed in oil. These two insulators are held in position by means of hollow clamp rings which are fastened to the insulators with set-screws and cement. The contact blades are fastened to the central insulator in a similar fashion.

The smaller figure shows the details of a contact. The contact arms are of hard drawn flat copper strips. Each fixed contact is forced downward by three coiled springs which are carried on the studs on which the fixed contacts slide, and which are screwed on the bottom of the insulator. These fixed contacts, as well as the blades, have ground surfaces. On closing the switch, each contact blade slides under the corresponding fixed contact, and, owing to the arrangement of the springs, a perfect self-aligned contact results.

The shape and position of the shunt or arc rupturing contacts are such as to prevent any possibility of the arc being taken by the main contacts. These auxiliary contacts are readily replac-



CONTACT OF THE 60,000-VOLT OIL SWITCH

able. In the illustration the oil level indicator can be seen on the left of the insulator, the construction of which is exposed. Should the oil leak out, or for any other reason recede below a safe level, the indicator closes the pilot circuit and warns the attendant by ringing a bell or lighting a lamp, as may be desired.

Each switch is tested at 120,000 volts, and, in installing, the iron top and tanks are grounded, making it perfectly safe for the operator to handle the controlling device. The three-pole switch is made up of three of the units described above, connected by rods and the crank on each operating shaft to either a motor, magnet or hand-operated controlling device, and the operation of either of these devices may be controlled by plain overload, time delay overload or reversed current relays. Each pole of the switch may be mounted in either soapstone or brick compartment or upon iron framework.

The switches are so designed that they may readily be taken apart for shipment and reassembled without skilled labor. No fine adjustments are necessary, the parts being merely bolted together. Every detail of the switches is of robust character and every precaution has been taken to insure their continuous operation.

INDUSTRIAL

A CABLE EXHIBIT AT THE WORLD'S FAIR.

THE Standard Underground Cable Company has an interesting exhibit in Section 3 of the Electricity Building at the World's Fair at St. Louis, which exhibit shows a cross-section of an actual conduit consisting of seventy-two ducts with a manhole at either end, one manhole being complete with a cover, the other being open. A trench seven feet deep and five feet wide extends the entire length of this conduit, enabling close inspection of the method of laying conduits, including the wrapping, concrete base and top, and the general construction of the manholes, showing hangers, pipes to poles, etc.

At one end in the manhole is shown a capstan rigged up for drawing in cables and connected to a cable which is mounted on a reel at the other manhole, the cable being drawn through the ducts and part of the ducts being split so as to show the method of fastening cables to rope, etc. From the manholes cables go to distributing poles, showing the method of distribution to ærial cables for telephone, electric light and street railway work, with various terminals used to protect the ends of the cables in such work.

The company also shows samples in handsome cases of all the various cables and appliances which it makes, and an examination of the exhibit will show in detail the method of installing conduits and of drawing the cables into them.

DOUBLING ITS CAPITAL STOCK.

A DOULING of its capital stock, which has been $1,000,000, is announced by the Crocker-Wheeler Company, manufacturers and electrical engineers, of Ampere, N. J. The company, which is the largest of the independent electrical manufacturers, was organized in 1892 by Dr. Schuyler Skaats Wheeler and Professor Francis B. Crocker on a relatively modest basis. It now has fifteen branch offices from Boston to San Francisco, and does one of the largest businesses in the world in electric power apparatus. The capitalization was several times increased, until in 1899 it had become $1,000,000. In view of the rapidly expanding business the stockholders have now decided to increase this amount to $2,000,000.

CHLORIDE CELLS AT THE EXPOSITION.

THE Electric Storage Battery Company of Philadelphia has at the St. Louis Exposition the most extensive and comprehensive exhibit that has ever been made of storage batteries and auxiliaries. It is located in Block 20, Electricity Building.

A conspicuous feature is a map about thirty feet in height by forty-five feet in length, which, by an ingenious arrangement, shows the distribution of chloride accumulator installations throughout the United States Illuminated glass jewels designate the locations and characters of the installations, whether for railway, central station, isolated lighting and power service, yacht plants or telephone installations

There is set up in a model battery house a complete operating installation of chloride accumulators for railway service. Specimens of chloride accumulators, ranging in size from a sixty-one-horsepower type of cell to the smallest laboratory cells, are also shown, together with a complete exhibit of the Exide battery used for electric automobile work.

In another section of the exhibit there are five types of switchboards, together with end-cell switches, storage battery recording instruments, etc.

A NEW HOME FOR HENRY R. WORTHINGTON.

THE Henry R. Worthington Hydraulic Works at the corner of Rapelyea and Van Brunt streets, Brooklyn, are shortly to be removed to Harrison, N. J., to occupy the new $2,000,000 plant of the International Steam Pump Company now nearly completed. The Brooklyn site consists of two city blocks, or about four and one-half acres, while the Harrison plant is located on a thirty-five-acre tract, and contains eighteen acres of floor space.

The Worthington Company is one of the oldest and largest manufacturing concerns of Brooklyn, having been founded in 1843 by Henry R. Worthington, the inventor of the duplex steam pump and other hydraulic devices. About 2000 men are employed in the South Brooklyn works, and many will undoubtedly go to the new plant at Harrison, which will accommodate from 5000 to 6000 men. The Brooklyn works will probably be sold, the company having already disposed of its large foundries at Elizabethporth, N. J.

HOW THE STANDARD UNDERGROUND DOES IT.

The Standard Underground Cable Company has now seven district or branch offices throughout the country, covering the whole of it from Maine to California, namely: The Northeastern Sales Department, Delta Building, Boston, Mass.; the Eastern Sales Department, 56 Liberty Street, New York City, N. Y.; the Southern Sales Department, Betz Building, Philadelphia, Pa.; the Central Sales Department, Westinghouse Building, Pittsburg, Pa.; the Western Sales Department, The Rookery Building, Chicago, Ill.; the Southwestern Sales Department, Security Building, St. Louis, Mo.; and the Pacific Coast Sales Department, Crossley Building, San Francisco, Cal.

ALLIS-CHALMERS-BULLOCK ELECTRIC.

The Allis-Chalmers Company has entered into an arrangement with the Bullock Electric Manufacturing Company, whereby the business of the latter will be taken over, and the business of both companies carried on as that of a single interest.

The business of the Bullock Company will be conducted as heretofore by its present management under the form of a new Bullock Electric Manufacturing Company, organized under the laws of the State of California, with George Bullock as president and Joseph S. Neave as vice-president.

THE ABNER DOBLE COMPANY EXPANDS.

The Abner Doble Company, of San Francisco, engineers, manufacturers of tangential water wheels with needle regulating nozzles, dealers and manufacturers in iron, steel and metals, announces the organization of their Consulting Engineering Department in charge of Robert McF. Doble, who has had considerable experience in the design, construction and operation of high head hydro-electric power plants and long distance power transmissions. Abner Doble Company are now also prepared to take entire charge of the design and construction of power plants, pumping plants and other engineering work, guaranteeing maximum economy and efficiency in construction and in operation.

PERSONAL.

Mr. E. A. Thornton, superintendent of the Haywards division of the Oakland Transit Consolidated, has been appointed to the managership of the Petaluma and Santa Rosa Electric Railway system now under construction.

Mr. A. J. Bowie, Jr., the well known electrical engineer of San Francisco, left for San Antonio, Texas, on May 8th, where he will remain in the service of the Government in electro-irrigating development until about August, next.

Mr. Mark A. Replogle, of Akron, Ohio, has been retained by The Replogle Governor Works as chief engineer, and the manufacture and sale of the new Replogle "Differential" water wheel governor will now be actively prosecuted.

Mr. James W. Lyons, who has been for many years associated with the Allis-Chalmers Company in the capacity of engine salesman, has been appointed manager of the newly created Power Department of the Allis-Chalmers Company, with headquarters in Chicago.

Mr. J. C. McQuiston, until recently secretary, has been appointed superintendent of the Westinghouse Companies' Publishing Department, having charge of matters relating to the publicity of the products of the various Westinghouse interests in the United States and Canada.

Mr. Putnam A. Bates, who is well and favorably known on the Pacific Coast from his former secretaryship of the Crocker-Wheeler Company, announces that he has formed a partnership with Mr. John Neilson for the practice of consulting electrical engineering under the firm name of Bates & Neilson, with offices at 42 Broadway, New York.

Mr. H. H. Noble, president of the Northern California Power Company and of the Pacific Coast Electric Transmission Association, left for Honolulu on a trip for recreation and recuperation on May 9th. He returned on June 6th.

Mr. Robert McF. Doble, of San Francisco, consulting and supervising engineer, making a specialty of hydro-electric power developments and long distance power transmission, announces that he has become identified with the Abner Doble Company, engineers, and manufacturers of tangential water wheels with needle regulating nozzles.

Mr. C. C. Tyler has resigned his position as superintendent of the works of the Westinghouse Electric and Manufacturing Company, at East Pittsburg, Pa., and has been appointed general superintendent of all the works of the Allis-Chalmers-Bullock interests in the United States. Mr. Tyler, who will enter upon his new duties on June 15th, will make his headquarters at Milwaukee.

Mr. H. T. Croll, who has been in charge of the Salt Lake City, Utah, office of the Allis-Chalmers Company for several years, and who was before that the representative of the E. P. Allis Company, at Spokane, Wash., has been appointed to the charge of the Allis-Chalmers office in San Francisco as the successor of Mr. Geo. E. Ames, who has resigned. Mr. Croll's San Francisco office is at 623 Hayward Building.

NEWS NOTES.

LOS ANGELES, CAL.—T. H. Cochrane, treasurer of the Soldiers' Home, Los Angeles, will receive bids up to June 17th for electrical repairs to the Ward Memorial Hall.—*Los Angeles Times.*

PENDLETON, OR.—The Washington and Oregon Power Company will commence work at once on their plant on the South Fork of the Walla Walla.—*Pendleton East Oregonian.*

SAN FRANCISCO, CAL.—The McCloud River Electrical Power Company has filed a petition in bankruptcy. The creditors are William Ellery, $5000, and M. Brooks, $805.17.—*Edwards' Abstract.*

LOS ANGELES, CAL.—Sealed bids will be received by the Supervisors up to 2 p. m., June 27th, for a franchise for wires and poles for conducting electricity for light, power and heat.—*Los Angeles Times.*

PORTLAND, OR.—Manager George W. Bredehoft of the Daisy Mine, at Neal, near Boise, Idaho, has completed arrangements for the installation of electrical machinery.—*Portland, Oregon, Telegraph.*

COTTONWOOD, CAL.—Harry L. Shannon is promotor of a company which proposes to take water from Hat Creek, just below Mt. Lassen, and use it for power purposes. The company will erect an electric generating plant to cost $100,000.—*Cottonwood Advocate.*

SEATTLE, WASH.—The Ballard Electric Company will shortly commence work on its new building, which will be constructed of iron and wood. A 250-kilowatt dynamo has been ordered so that lights can be furnished to all parts of the city.—*Seattle Post-Intelligencer.*

FRAZIER VALLEY, CAL.—Dr. J. R. Curnow, president of the Globe Light and Power Company, of San Jose, is at present in Visalia arranging for commencing work on the mammoth power plant on the Tule River, from which power will be generated for operating the Tulare and Eastern Tulare County Railway.—*Tulare Register.*

SAN FRANCISCO, CAL.—The Citizens' Alliance is taking up the case of Charles L. Pryal, a wiring electrician, against the San Francisco Labor Council, the Electrical Workers' Union (local No. 6), Electrical Workers' Union (local No. 151), the Painters' Union (local No. 19), *et al.*, and through its attorney, Bush Finnell, will file a complaint in the Superior Court. The plaintiff sues for $25,000 damages, alleging conspiracy on the part of the defendants and persecution. Pryal is a non-union electrician, and the complaint recites numerous cases wherein he has been obliged to forfeit his contracts at heavy losses on account of these unions threatening his customers with boycott if Pryal should be allowed to finish his work. Pryal moved his business successively to San Mateo, Santa Rosa and then back to San Francisco, but the persecution continued. Mr. Finnell, head of the law department of the Citizens' Alliance, says that this is the most flagrant case of unlawful persecution of a non-union laborer by the unions that has been brought to the notice of the Alliance. —*San Francisco News Bureau.*

COMMUNICATION.

CORVALLIS, OR.—The city trustees have granted a franchise to the Independent Telephone Company.—*Corvallis Times.*

SAN BERNARDINO, CAL.—The Home Telephone Company has 400 'phones running here and no party lines.—*San Francisco News Bureau.*

ST. GEORGE, UTAH—The Rocky Mountain Bell Telephone Company has been granted a franchise to construct lines along the streets and roads of this county.

REDDING, CAL.—The people of the Cottonwood district are preparing to put in a telephone line running between Cottonwood and Balls Ferry.—*Redding Searchlight.*

SAN DIEGO, CAL.—The county supervisors have contracted with the Home Telephone Company for a telephone service to be placed in the offices of the various county officials.

GRANT'S PASS, OR.—J. H. Cradlebaugh, of the Merlin Townsite Company, states that the company will put in a telephone line running from Merlin to Galice—*Grant's Pass Journal.*

WHEATLAND, CAL.—Dooley Bros., of this place, are constructing a telephone line running from Fairview, Sutter County. The objective is supposed to be Wheatland.—*Sacramento Bee.*

ROCKFORD, WASH.—The Rockford Telephone Company has been organized with C. S. Shepard as president, G. Saunders, vice-president, O. Sullivan, secretary. The company will con-

struct a line from Rockford to Mt. Hope.—*Seattle Post-Intelligencer.*

SALEM, OR.—The Pacific States Telegraph and Telephone Company has approved the survey for a new rural telephone line running to West Salem, and the company is now securing contracts from residents along the road.—*Salem Statesman.*

SAN FRANCISCO, CAL.—The Sunset Telephone and Telegraph Company has contracted with J. H. Wilson for the construction of an office building on Franklin Street, between Fifteenth and Sixteenth, Oakland, at a cost of $4000.—*Pacific Builder.*

SANTA ROSA, CAL.—The citizens of Geyserville and Alexander Valley have selected H. L. Mame, M. M. Young and C. L. Patterson as a committee to arrange for the construction of a telephone line from Geyserville, through Alexander Valley to Lytton.

PENDLETON, OR.—Arrangements have been made for the construction of a telephone line between Pendleton and Pilot Rock, a distance of about sixteen miles, at an estimated cost of $800. Brock & McCamas, Pendleton, will act as agent in this city. —*Pendleton East Oregonian.*

HOLLISTER, CAL.—The Supervisors have passed an ordinance granting the National Oil and Transportation Company the right to erect, maintain and operate telephone and telegraph lines along the public highways of San Benito County in connection with its proposed pipe line.—*Hollister Free Lance.*

GRANGEVILLE, IDAHO—The Grangeville and Salmon River Telephone Company has completed its organization by the election of J. O. Levander as President. The company will construct and operate a telephone line about 100 miles long running between Grangeville and Salmon Meadows.—*Grangeville Press.*

LEBANON, OR.—W. A. Bartley, of this place, and others have organized a rural telephone company for the purpose of establishing a rural line connecting with the central station of the Pacific States Telephone Company at Lebanon. The line will extend about seven miles.—*Lebanon Express-Advertiser.*

SANTA ROSA, CAL.—The Mark West and Santa Rosa Telephone Company has been organized at Santa Rosa. Phones will be ininstalled on the route between Santa Rosa, Mount Olivet and Mark West. Nearly all of the capital stock has been subscribed. A franchise has been petitioned for and will be granted at the May meeting of the Board of Supervisors. At Santa Rosa they will be placed in connection with the long distance lines of the Sunset Telephone Company. The officers are: Raphael Peterson, president; John M. Laughlin, secretary; Harry Hall, treasurer. These three, with Samuel Talmadge and S. W. Purrington, constitute the board of directors.—*San Francisco News Bureau.*

NEW INCORPORATIONS.

SPOKANE, WASH.—Spokane Electrical Supply Company; increase of capital stock from $10,000 to $15,000.—*Spokane Spokesman Review.*

VICTORIA, B. C.—Elsie Lake Power Company (Ltd.); capital stock, $10,000; incorporators not known at present.—*Victoria, B. C., Colonist.*

SONOMA, CAL.—Sonoma-Embracadero Rural Telephone Company; capital stock not given; incorporators, Robert Hall and others.—*Sonoma Expositor.*

EUGENE, OR.—Crow Telephone Company; capital stock, $1000; incorporators, Charles Hadley, William Mathers, Joseph Hooker and others.—*Eugene Gard.*

SALT LAKE, UTAH.—The Pan Power and Electric Company; capital stock, $10,000; incorporators, W. L. Cameron, W. M. Bradley and others.—*Salt Lake Tribune.*

PHŒNIX, ARIZ.—Johnson Electrical Manufacturing Company; capital stock, $200,000; incorporators, W. Frederick Nutt, Charles H. Johnston and others.—*Tempe News.*

SALT LAKE, UTAH.—Millard County Telegraph and Telephone Company; capital stock, $6000; incorporators, T. C. Callister, G. Y. Wallace and others.—*Salt Lake Tribune.*

HELENA, MONT.—Billings Mutual Telephone Company; capital stock, $40,000; incorporators, H. W. Rowley, M. A. Arnold, P. B. Moss and others.—*San Francisco News Bureau.*

SANTA CRUZ, CAL.—Watsonville Light and Power Company; capital stock not given; incorporators, Fish M. Ray, Joseph C. Love, C. W. Wallace and others.—*San Francisco Call.*

LOS ANGELES, CAL.—United States Long Distance Telephone Company; capital stock, $3,000,000; incorporators, C. A. Gates, A. F. Morlan, L. J. Maguire and others.—*San Bernardino Times-Index.*

RENO, NEV.—Nevada Water, Power and Light Company; capital stock, $1,000,000; incorporators not given. This company has purchased all the franchises of the former company.—*Reno Gazette.*

SALT LAKE, UTAH.—The Gamble-Shepard Company; capital stock, $5000; incorporators, J. B. Hoyt, J. W. Guild and others. The company will establish an electric plating plant.—*Salt Lake Tribune.*

RED BLUFF, CAL.—Red Bluff and Paskenta Telephone Company; capital stock, $5000; incorporators, A. Gallatin, E. D. Gardner and others. Object to construct a rural telephone line. —*Red Bluff News.*

EUREKA, CAL.—North Mountain Power Company; capital stock, $500,000; incorporators, J. Ralston, J. B. Rogers, Robert J. Tyson and others. Object to erect power plant on the Smith River.—*Eureka Times.*

CALIFORNIA ELECTRIC RAILWAY ADVERTISING COMPANY—Incorporated at San Francisco by M. H. Wilson, B. A. Wilson, W. K. Auchinclose, P. E. Hatch and E. C. Denio, with a capital stock of $60,000, fully subscribed.

HOME TELEPHONE AND TELEGRAPH COMPANY—Incorporated at San Diego by C. E. Sumner, Arthur Wright, F. F. Graves, D. F. Boyce and W. M. Godfrey, with a capital stock of $500,000, of which $10,000 has been subscribed.

UNITED STATES LONG DISTANCE TELEPHONE COMPANY—Incorporated at Los Angeles by C. A. Gates, A. F. Norlan, L. J. Maguire, J. I. Samuels and W. B. Brown, with a capital stock of $3,000,000, of which $70,000 is subscribed.

LOS ANGELES GAS AND ELECTRIC COMPANY—Incorporated at Los Angeles, Cal., by W. D. Cline, W. M. Van Dyke, Wm. Baurhyte, W. A. Cheney and R. M. Adams, with a capital stock of $5,000,000, of which $500 has been subscribed.

VISALIA, CAL.—Visalia Electric Railway Company; capital stock, $1,000,000; subscribed, $24,000; incorporators, Harold Wheeler, Ben M. Maddox, W. H. Hammond, C. J. Giddings and S. Mitchell.—*San Francisco News Bureau.*

TUOLUMNE, CAL.—Central California Electric Company; capital stock, $500,000; subscribed, $99,390, by J. L. Gibbs, G. G. Grant, J. E. Conde, B. F. Eastman, M. J. Gardner, J. J. Gibbs and Fred Fette, Jr.—*San Francisco News Bureau.*

DEERE CREEK WATER AND POWER COMPANY—Incorporated at San Francisco by George F. Turbush, C. H. Greene, I. N. Rosencrantz, J. L. Ulrich and Peter Heuer, with a capital stock of $25,000, of which $500 has been subscribed.

BAKER CITY, OR.—Oregon Power and Development Company; capital stock, $200,000; incorporators not given. The company will construct an electric power plant on Granite Creek, in the Greenhorn mining district.—*Portland Oregonian.*

BEND, OR.—Bend Electric Power Company; capital stock, $10,000; incorporators, C. C. Hutchinson, H. W. Reed and J. Steidle. The company will build a power plant, power being generated by a seventy-five-horsepower turbine wheel.—*Prieville Journal.*

BELLINGHAM, WASH.—International Telephone Company; capital stock, $50,000; incorporators, A. M. Hadley, A. E. Tregent and William Farrell. The company will lay a cable from Bellingham to Victoria, B. C., via the San Juan Islands.—*Bellingham Herald.*

ELECTRIC EQUIPMENT COMPANY OF SAN FRANCISCO—Capital stock, $25,000; shares $1 each; subscribed $50, by E. H. Forst, H. T. Henning, W. S. Grover, G. A. and J. H. L. Folkers, 10 shares each; place of business, San Francisco.—*San Francisco News Bureau.*

SANTA CRUZ, CAL.—Co-operative Electric Company; capital stock, $50,000; shares, $10 each; subscribed, $11,050, by Henry Willey, 500 shares; H. E. Irish, 200; J. J. C. Leonard, 250; D. A. Clark, 100; F. W. Swanton, 5 shares; place of business, Santa Cruz.—*San Francisco News Bureau.*

SAN BERNARDINO, CAL.—Pacific Electric Heating Company; capital stock not given. Has incorporated for the purpose of doing a general manufacturing, buying and selling of electrical devices. E. H. Richardson is one of the incorporators. Place of business, Ontario.—*San Bernardino Sun.*

FINANCIAL.

VISALIA, CAL.—The Mt. Whitney Power Company has increased its capital stock from $300,000 to $1,000,000.—*San Francisco News Bureau.*

SAN FRANCISCO, CAL.—The February, 1904, statement of the United Railroads shows gross earnings of $482,403, a gain of $37,242 over February, 1903.—*San Francisco News Bureau.*

SAN FRANCISCO, CAL.—A dividend, No. 1, of twenty-five (25c.) cents per share on the issued capital stock of the California Gas and Electric Corporation has been declared, payable at the office of the company on May 16, 1904.—*San Francisco News Bureau.*

LOS ANGELES, CAL.—The Los Angeles Lighting Company has transferred to the Los Angeles Gas and Electric Company its business, franchises and properties. June 15th the latter company will vote on creating a bonded indebtedness of $4,000,000, secured by a deed of trust.—*San Francisco News Bureau.*

LOS ANGELES, CAL.—Deeds have been filed transferring to the Los Angeles Interurban Railway the property of the California Pacific Railroad Company, Los Angeles and Glendale Electric Railroad Company and Los Angeles Traction Company. The amount involved is stated as $2,038,808, of which $1,646,548 is for the Traction holdings.—*San Francisco News Bureau.*

OAKLAND, CAL.—The March, 1904, statement of the Oakland Transit Consolidated is as follows:

	Gross Earnings.	Expenses.	Net Earnings.
1904	$96,496.09	$52,997.95	$43,498.14
1903	88,526.40	46,731.72	41,794.68
Increase	$ 7,969.69	$ 6,266.23	$ 1,703.46

—*San Francisco News Bureau.*

HONOLULU, T. H.—The earnings of the Honolulu Rapid Transit Company for the first three months of 1904 were:

1904	Gross Earnings.	Expenses.	Net Earnings.
January	$27,491.65	$15,601.96	$11,889.69
February	23,969.50	15,828.36	8,141.14
March	27,494.20	16,977.57	10,516.63

—*San Francisco News Bureau.*

NEW YORK, N. Y.—At the annual meeting of the United Railroads of San Francisco, held May 6th, the following statement was presented for the year ending December 31, 1903:

Gross earnings from car fares	$6,243,219
Operating expenses	3,910,835
Net earnings from car fares	$2,332,384
Fixed charges	$1,536,438
Sinking fund	123,999
Dividends	480,000
Surplus	216,701
Net income from all sources	$2,357,138

The depreciation was placed at $157,500.—*San Francisco News Bureau.*

WATSONVILLE, CAL.—At a special meeting of the Watsonville Light and Power Company, held on May 11th, the stockholders authorized the creation of a bonded indebtedness of $200,000, the bonds to bear 5 per cent. interest and run thirty years. An official says that the company, which is controlled by the California Gas and Electric interests, will not find it necessary to issue these bonds for some time to come, as the improvements under way can be completed with the present resources. The laying of additional gas mains is about completed. The enlarged gas plant now has a capacity of 100,000 cubic feet per day. The company has a 350 horsepower electric light plant, but buys electric current from the Big Creek Power Company, of Santa Cruz.—*San Francisco News Bureau.*

SAN FRANCISCO, CAL.—At the annual meeting of the stockholders of the California Gas and Electric Corporation, held in the Rialto Building on May 3d, more than 90 per cent. of the stock was represented.

An official says that the annual report of the president for the year ending February 29, 1904, was received with satisfaction. Dividend No. 1 of 25 cents per share on the issued capital stock was declared, payable May 16, 1904, books closing May 10th. It was announced that $1,000,000 had been set aside for extensions and betterments during the present fiscal year. The following board of directors was elected: W. G. Henshaw, Leon Sloss, F. B. Anderson, F. W. Zeile, N. D. Rideout, E. J. de Sabla, Jr., John A. Britton, R. M. Hotaling, John C. Coleman, F. G. Drum and John Martin. The first two directors in the list replaced E. W. Hopkins and J. H. Meyer.

The board of directors organized by electing as officers: E. J. de Sabla, Jr., president; John Martin, first vice-president; F. G. Drum, second vice-president; John A. Britton, general manager; R. M. Hotaling, treasurer, and C. W. Conlisk, secretary. F. G. Baum is superintendent.

The annual statement is as follows:

Months.	Earnings.	Expenses.
March, 1903	$ 213,272.51	$ 124,561.76
April, 1903	218,749.72	113,888.50
May, 1903	222,936.43	120,054.36
June, 1903	222,287.81	126,731.36
July, 1903	213,473.47	127,503.46
August, 1903	227,656.33	137,158.24
September, 1903	248,921.81	157,320.74
October, 1903	244,279.09	148,142.89
November, 1903	249,409.86	143,165.06
December, 1903	277,943.30	148,352.97
January, 1904	276,513.05	147,763.88
February, 1904	273,465.94	149,598.43
Totals	$2,888,909.32	$1,644,241.65

	Profits.	Bond Interest.	Net Surplus.
March	$ 88,710.75	$ 61,089.81	$ 27,620.94
April	104,861.22	64,759.79	40,101.43
May	102,882.07	65,243.66	37,638.41
June	95,556.45	65,449.15	30,107.30
July	85,970.01	65,449.15	20,520.86
August	90,498.09	65,449.15	25,048.94
September	91,601.07	65,449.15	26,151 92
October	96,136.20	64,815.88	31,320.32
November	106,244.80	69,008.21	37,236.59
December	129,590.33	69,028.66	60,561.67
January	128,749.17	69,099.07	59,650.10
February	123,867.51	69,810.71	54,056.80
Totals	$1,244,667.67	$794,652.39	$450,015.28

The sinking fund of $150,000 was paid into the Mercantile Trust Company in March, 1904. At the meeting there was no action taken on the proposition to buy out the interests of the South Yuba Water Company and the Central California Electric Company, on which an option was secured, but the time will be extended. The purchase of the control of the Standard Electric Company and the United Gas and Electric Company was one of

the most important features of the year's transactions. A considerable amount of the $1,000,000 appropriated for betterments, etc., will be spent on the Standard electric transmission system. The voltage will be raised to 60,000, and new electrical apparatus will be installed for the operation of the Sacramento Electric, Gas and Railway system.

The estimate of earnings for the year 1903, as given out by the Mercantile Trust Company in its circular offering $1,500,000 of the California Gas and Electric Corporation bonds, was as follows:

Gross income, $2,250,000; manufacturing cost, maintenance and taxes, $900,000; gross surplus, $1,350,000; bond interest constituent companies, $450,000, leaving $900,000; bond interest corporation bonds, $377,500; net earnings, $522,500; sinking fund, $150,000; net surplus, $372,500.—*San Francisco News Bureau.*

TRANSMISSION.

SAN JOSE, CAL.—William Tregoning, assistant electrician at the Santa Clara Municipal Electric Works, was instantly killed on May 26th by accidentally touching a live wire.—*San Francisco Chronicle.*

SONORA, CAL.—C. T. Lindner has sold to John A. Britton the franchise granted him by the County Supervisors to maintain an electric power line along certain county roads.—*San Francisco News Bureau.*

BAKER CITY, OR.—W. J. Patterson will use electric power from the Rock Creek power plant for the purpose of pumping water for irrigation purposes. Each forty-acre tract will be provided with a pump and a seven horsepower electric motor.

OROVILLE, CAL.—A power plant is projected to furnish electric power for Oroville and vicinity. The company has 15,000 miners inches of water located on the Middle Fork of Feather River at Bald Rock. Surveyors will run ditch lines.—*San Francisco News Bureau.*

SANTA CRUZ, CAL.—William Henry, an employee of the California Powder Works, was killed here on May 26th whill fixing telephone wires. His wrist came in contact with the 11,000-volt wires of the Big Creek Power Company, and he died almost instantly.—*San Francisco Chronicle.*

SALT LAKE, UTAH.—Hugh Alfred, a civil engineer of this city, and Adolph Jessen, his assistant, were instantly killed at Bingham on May 26th by the surveyor's chain which they were using coming in contact with a 5000-volt wire of the Telluride Power Company.—*San Francisco Chronicle.*

LODI, CAL.—The Northern San Joaquin Electric Company has absorbed the plant and business of the Lodi Electric Light Works. Branch power lines will be run to Woodbridge, Acampo, Galt and Lockford. Arrangements are being made to install electric pumping plants in Cary Bros. water system and planing mill.

SACRAMENTO, CAL.—Frank Ross, assistant general manager of the Sacramento Electric, Gas and Railway Company, says a number of wires are to be taken down from the streets and improvements made to the plant. New machinery will be installed in the power house [substation?] to replace the old.—*San Francisco News Bureau.*

YREKA, CAL.—The Siskiyou Electric Power Company has purchased the plant and business of the Ætna Electric Light Company and is now engaged in extending the main power line from Fort Jones through Greenview to Ætna, twelve miles. This is the third plant bought out by the Siskiyou Power Company within the last six months.—*San Francisco News Bureau.*

FRESNO, CAL.—D. L. Wishon has filed applications in the United States Land Office for rights of way and sites for power plants and reservoirs in Fresno County. The main reservoir will be in Crane Valley, in the Sierras, and will have an area of 800 acres. It is understood that rights of way are to be secured for transmission lines to Stockton and San Joaquin Valley points.—*San Francisco News Bureau.*

CHICO, CAL.—The Bay Counties Power Company intends to increase the efficiency of the Butte Creek line. No construction work will be done at French Creek this year. When the second pipe line is completed, a third unit will be installed at the Nimshew power house, which will increase the output 5000 horsepower. It is expected to have this placed in position by August 1st.—*San Francisco News Bureau.*

SAN FRANCISCO, CAL.—A petition has been filed by William Ellery, of San Francisco, and A. Hochheimer and M. Brock, of Willows, asking to have the McCloud River Electrical Power Company adjudged bankrupt. These creditors have unsecured claims amounting to over $6000 against the company, which was incorporated under the laws of South Dakota, and has had its principal place of business in Shasta County, Cal.—*San Francisco News Bureau.*

PORTERVILLE, CAL.—Henley & Bursell, of Globe, have received a dispatch from Washington stating that their application for a right of way through the reserve east of Springfield had been granted and that the contest placed upon their right of way by A. G. Wishon had been dismissed. This means two large power plants for Middle Tule. The lower plant, known as the Globe plant, will begin this season. Its capital is furnished by San Jose parties. The power house of the Globe plant will be built near the club house.—*Porterville Enterprise.*

WALLA WALLA, WASH.—The Washington and Oregon Power Company has given contracts as follows: To the Pelton Water Wheel Company and to the Wagner-Bullock Electric Company, both of San Francisco, for three multiple units, each to be direct-connected to a 500-kilowatt, Bullock, three-phase generator, to run at a speed of 600 revolutions per minute under an effective head of 356 feet. Exciter units also accompany the order, and power is to be furnished to the Walla Walla Gas and Electric Company. Samuel Storrow, of Los Angeles, is consulting engineer.

SEATTLE, WASH.—The Columbia Improvement Company started the first unit of its Puyallup River plant on April 12th and the second unit on April 25th, both of them being put into commission on regular service at full load within two hours after starting. These units are each of 7500 horsepower, and are the first half of the plant, the remaining two units being now under installation. As such it is the largest hydro-electric plant in this country, outside of Niagara. Both units now in operation supply current to a single bank of three transformers, each of which is rated at 5000 kilowatts.

EUREKA, CAL.—President C. O. G. Miller has returned from his trip to the power site on the Trinity River. He was accompanied by Superintendent Petch of the Eureka Lighting Company and S. W. Garretson of Los Angeles. The company now owns about 640 acres of land on the Trinity, and as the assessment work required by law has been done they do not fear any claim jumping, although notices of mining claims have been posted on the property. A survey party is at work setting the grades for a road to be constructed between the site and the county road. The plant is to be located seventy miles from Eureka, and it is intended to supply power to adjoining towns and to the various creameries and mills on the west side of the mountains. The party met other surveying crews in the Smith River country.

MARYSVILLE, CAL.—George F. Taylor, secretary; George B. Morse, mining man, and John B. Irish, attorney, are leaders in a proposition to build an electric road to connect Marysville and Downieville. Mr. Irish speaks of having almost unlimited power on the North and East Forks of the Yuba River, insuring current for ten times the business of the new road. It is proposed to generate the electricity at Goodyears, four and one half miles below Downieville. The road will be sixty-eight miles long, following practically the contour of the river, and Downieville will be the highest place on the road. The grade will nowhere be over 1 per cent. Mr. Taylor estimates the cost at $750,000,

but electricians place it at $1,000,000. Money for the preliminary survey is available. An 80,000-acre timber belt will be tapped, and a fruit belt will also be tributary to the line. All the mountain towns will be benefitted, and a continuation of the road through Sutter County, via Sutter City, to Colusa, would naturally follow.—*Marysville Democrat.*

LOS ANGELES, CAL.—The Pacific Electric Railway Company of Los Angeles is building a branch line to Newport Beach by a coast line route. The time over this line is to be fifty minutes for the thirty-nine miles between Los Angeles and Newport Beach, including stops. A speed of 100 miles an hour, it is calculated, may be maintained for considerable distances along certain sections of the road with the utmost safety to passengers. It is hoped to have this new line in operation very soon. The portion of the line now incomplete is from Ocean Beach to Newport Beach, a distance of fifteen miles. From Ocean Beach to Los Angeles the Long Beach line will be used. Leaving Ocean Beach the new line has a matchless ocean view its entire distance, with a pleasing background of rising hills and broken fields. The unique construction feature of this line is a fill of a marsh of more than two miles, south of Alamitos Bay, which must be crossed to maintain a coast line. Across this marsh is a trestle, serving as a temporary roadbed for the work trains. On either side of this trestle is now being built a fill of dirt, stones and gravel. Three dirt trains, each with a capacity of 850 yards daily, are now busy filling in a perminent roadbed along the trestle. The track is to be standard gage, laid with sixty-pound rails. The poles used are forty-five feet in height, set nine feet in the ground and fifty poles to the mile.

EUREKA, CAL.—The Wagner-Bullock Electric Company has closed contracts to supply the North Mountain Power Company, of Humboldt County, with two 750-kilowatt, three-phase generators, and a third unit will be ordered soon. These machines will be manufactured at the Bullock Electric Manufacturing Company's works in Cincinnati, and will be up to the best modern practice. Twenty-five cycle apparatus will be used throughout the system, which will transmit electric power seventy-five miles to Eureka at 33,000 volts, and will probably be increased to a capacity of 20,000 horsepower in the future. Switchboards and transformers in banks of 300 kilowatts have been ordered. The generators are designed to be direct-connected to Stillwell-Bierce water wheels, which will be operated under a head of 600 feet. The equipment for the substations has not been fully decided upon. Work has been commenced at both ends of the transmission line under the general direction of Chief Engineer J. C. Ralston and J. B. Rogers, assistant in charge of the work. The contractors claim to be able to deliver the machinery in October, and it is the intention to complete the plant in time to transmit power to Eureka before January 1, 1905. More than half of the 500,000 shares of the North Mountain Power Company, which was incorporated for the purpose of developing an electrical power plant on the Smith River to supply Eureka and the adjacent towns, has been subscribed, and work has begun. The company was incorporated under the laws of the State of California September 24, 1902, with a capitalization of $500,000. The principal stockholders are John H. Vance and William Carson, of Eureka, and John L. Koster, Fred J. Koster, D. G. Scofield, W. H. Metson and Robert J. Tyson, of San Francisco, the exact number of shares subscribed being 284,000. J. Ralston and his assistant, J. B. Rogers, are engineering the work and have crews in the field. Machinery and the necessary wires and insulators have been ordered. The office of the secretary, Robert J. Tyson, has been established at 18 California Street. The water rights and ditches of "Compagnie Francaise," a French mining company, have been purchased. Immediately upon the completion of the initial line into Eureka work will begin upon the company's water rights on the South Fork of the Trinity, in Trinity County, and upon all the branches of the Smith River in Del Norte County.

TRANSPORTATION.

VALLEJO, CAL. The Vallejo, Benecia and Napa Valley Railroad Company has been granted permission to lay its tracks along certain streets in Vallejo.—*Vallejo Chronicle.*

POINT RICHMOND, CAL.—T. M. Morgan has commenced making a survey for an electric railroad to run through certain streets of Point Richmond.—*Point Richmond Leader.*

OROVILLE, CAL.—It is learned that the officials of the Diamond Match Company are considering the matter of building an electric railroad between Oroville and Barber.—*Sacramento Bee.*

OAKLAND, CAL.—An ordinance has been passed granting the San Francisco, Oakland and San Jose Railway Company a franchise to construct and maintain additional electric railways in Oakland.

BALLARD, WASH.—F. E. Sander has applied for a franchise for the Ballard and Everett Interurban Electric Line. He states that work will begin as soon as the franchise is granted.—*Seattle Post-Intelligencer.*

EUREKA, CAL.—J. C. Bull, Jr., has petitioned the city council for a franchise to construct and operate an electric railroad in that city. The franchise will be put up for sale on June 9th. —*Eureka Times.*

LOS GATOS, CAL.—President O. A. Hale, of the San Jose-Los Gatos Interurban Railroad Company, has completed arrangements for the transfer of the company's property to the new management.—*Los Gatos Mail.*

HONOLULU, T. H.—The Hawaiian Electric Company has received a cablegram from Washington stating that its franchise bill for an electric railway has passed the third reading in the House of Representatives.

FRESNO, CAL.—Manager A. G. Wishon of the Fresno Traction Company states that surveyors are at work on the proposed Yosemite Valley line and will probably have the survey completed by August 1st.—*Fresno Republican.*

SAN FRANCISCO, CAL.—The Vallejo, Napa and Benecia Electric Railway Company has closed a contract with the Westinghouse Electric and Manufacturing Company for the electrical equipment for a single-phase, alternating current, electric railway.

WALLA WALLA, WASH.—J. S. Halloway, representing Boston capital, states that work will begin on the construction of an eleven mile interurban electric railway connecting Walla Walla with Milton and Freewater within two months.—*Tacoma Ledger.*

SAN JOSE, CAL.—F. S. Granger, recently of the San Jose and Los Gatos Interurban Railway, has opened offices in the Ryland Building. He is now promoting several lines radiating from this city. George C. Chadwick, of San Francisco, has been engaged to survey routes.

SANTA ROSA, CAL.—The Petaluma and Santa Rosa Railway Company has petitioned the City Council for a franchise to construct and maintain an electric railroad over certain streets. The matter will be considered at the next meeting of the Council. —*Santa Rosa Press-Democrat.*

SAN JOSE, CAL.—The stockholders of the San Jose and Los Gatos Interurban Railway Company on May 11th elected F. E. Chapin, general manager; O. A. Hale, president; W. C. Andrews, Gus Lion, Lloyd M. Robbins and Archibald Bernard, directors for the ensuing year.—*San Francisco News Bureau.*

SAN JOSE, CAL.—The directors of the San Jose, Los Gatos and Interurban Railway Company have under consideration the proposal to establish and install a power plant in the vicinity of the present car barns. No definite conclusion has been reached, but it is quite amongst the possibilities that in the near future a plant costing between $75,000 and $100,000 will have to be installed to meet its increasing business.

VENTURA, CAL.—Plans have been formulated for the construction of the Ventura and Ojai Valley Electric Railway, which is

intended to operate between the towns in Ventura County as a pony freight. Negotiations are at present being conducted by Huntington for the purchase of the Ventura street railway system which extends some distance upon the proposed road. The purchase of this, which will give a franchise in Ventura, is said to be the first step toward the construction of the line. The road will follow the highway from Ventura to Nordhoff on the one side and upon the other to Oxnard and Santa Paula, with branches into the Simo Valley and to Hueneme. The best sections of the county will be covered by the line, which will bring to water supplies that now never reach the market. It is also intended to carry passengers.—*San Francisco Chronicle.*

EUREKA, CAL.—George Henderson, of the Eureka electric railway system, says that work was begun April 25th on the four-mile extension of the local line. Six miles of road are already in operation in Eureka, electric power being supplied by the Eureka Lighting Company. According to Mr. Henderson, work is to be commenced within sixty days on the proposed electric road from Eureka to Arcata, which will be eleven miles in length, passing through a territory having a population of 28,000, exclusive of the 11,000 inhabitants of the former city. At the last meeting of the City Council the right to transport freight to points within Eureka was granted the company, removing the last obstacle to the profitable operation of the road. Specifications are out for a 1000-horsepower steam plant in Eureka for the operation of the entire system until the projected water power electric transmission plant can be constructed. This would occupy about three years. After the water power plant is completed the steam plant will be held in reserve.—*San Francisco News Bureau.*

PETALUMA, CAL.—A representative of the Petaluma and Santa Rosa Railroad says that tracklayers are a mile and a half beyond Meechams, making nine and one-half miles of road completed on May 18th. A half a mile of track is laid daily. A new construction crew began work north of Sebastopol, and one between that point and Santa Rosa, last week. The road will be completed to Sebastopol by July 4th, but the overhead construction work will delay the opening of the road until August 15th. About that date it is expected that the entire thirty-two miles of line from Petaluma to Forestville and from Santa Rosa to Sebastopol will be in operation. Electric power will be supplied from the Bay Counties transmission lines, but as soon as possible the company will erect an auxiliary steam plant, which will probably be located at Petaluma. An additional forty-ton locomotive will soon arrive for use on the road during construction. A number of capitalists and persons identified with the Petaluma and Santa Rosa system visited Petaluma May 14th. President Lloyd and Secretary George Tourny, of the German Bank, Thomas Archer, A. D. Bowen, B. H. Dibblee and Alfred Meyer were included. The road will probably be double tracked within three years.—*San Francisco News Bureau.*

ILLUMINATION.

CORONADO BEACH, CAL.—The Tent City is to have electricity installed for lighting purposes in time for the coming season.

CANTELOUPE, OR.—The question of putting in a municipal electric lighting plant is being discussed by the town council.

DINUBA, CAL.—The owners of the Alta District Planing Mill are considering plans for putting in an electric lighting system.

POINT RICHMOND, CAL.—The electric lighting plant at Pinole was destroyed by fire on May 21st. The loss is estimated at $1000. —*Point Richmond Leader.*

GRASS VALLEY, CAL.—Work is now under way on the Central California Electric Light and Power Company's extension from Wolfe Street to Dead Man's Flat.

CENTRALIA, WASH.—The town authorities have advertised the municipal electric light plant for sale or lease. Bids will be opened June 20, 1904.—*Centralia Bee-Nugget.*

PETALUMA, CAL.—The lighting contract for the new theater building has been sub-let by Hinson & Jones, of San Rafael, to the National Electric Company, of San Francisco.

SEATTLE, WASH.—The Seattle Lighting Company will expend $20,000 in the next three months in relaying gas mains in the Harvard Avenue paving district.—*San Francisco News Bureau.*

OCEAN PARK, CAL.—The Town Trustees have arranged for the erection of 2000-candle-power arc lamps for street lighting purposes with the Edison Electric Company.—*Los Angeles Herald.*

MAPLE FALLS, WASH.—The new management of the B. B. Shingle Company contemplate putting in an electric light plant at the mill. J. B. Ashlund is manager of the plant.—*Maple Falls Leader.*

HAILEY, IDAHO—The Idaho Electric Supply Company will renovate and improve its plant, installing new machinery, poles, etc., and increasing its capacity. Leo Cramer is president of the company.

LOS ANGELES, CAL.—The Los Angeles Gas and Electric Company, at a special meeting on April 27th, considered the purchase of the Los Angeles Lighting and the Los Angeles Electric Company's plant.

BELLINGHAM, WASH.—The city council has abandoned the project for a municipal electric lighting plant and has let a contract for street illumination for three years to the Bellingham Bay Improvement Company.

GRANTS PASS, OR.—The city authorities have granted a franchise to the Condon Water and Power Company to erect poles along the public streets for the purpose of furnishing light and power.—*Grants Pass Journal.*

MADERA, CAL.—The Madera Light Works are to be rebuilt and remodeled. A 150 horsepower Babcock & Wilcox high pressure boiler and a triple expansion engine of 150 horsepower will be installed. Work will begin at once.

LOS ANGELES, CAL.—The Santa Fe Railroad Company is figuring on a plan for illuminating the rim of the Grand Canyon in the vicinity of Bright Angel tavern, thus making it possible to see a portion of the dark chasm at night.

SEATTLE, WASH.—Advices from Washington state that appropriations for the Puget Sound Navy Yard include $4000 for extensions to the electric lighting plant and $2000 for extensions to the telephone system.—*Seattle Post-Intelligencer.*

SEBASTOPOL, CAL.—The Trustees have granted G. W. Swain the right to construct and operate in Sebastopol poles, wires and other conductors for the transmission of electricity for light and power purposes.—*San Francisco News Bureau.*

BALLARD, WASH.—H. A. Starkey has paid over $2500 for an electric lighting franchise in this city. Work will be begun at once by Mr. Starkey and J. A. Ritchie, who will complete the plant in six months, at an estimated cost of $60,000.—*Seattle Times.*

SACRAMENTO, CAL.—Frank Ross, assistant general manager of the Sacramento Electric, Gas and Railway Company, says that the company will undertake a number of improvements in its lighting system. New machinery will be installed in the power house.—*Sacramento Bee.*

MENDOCINO, CAL.—The Mendocino Electric Light and Power Company has taken possession of the Mendocino Lighting Company's plant. In the reorganization the old company accepted a flat price of $15,000, it not being held to make the contemplated improvements. J. Grindle is president of the company and Albert Brown secretary.—*San Francisco News Bureau.*

SALT LAKE, UTAH.—Garff & Son, of Logan, Utah, have filed with the State Engineer appropriation papers for fifty second-feet of water in Alpine Creek, Utah County, and an appropriation for 200 second-feet of water in Utah Fork Canyon Creek. The appropriations are for the purpose of developing electrical power. It is claimed that a total of 2500 horsepower will be developed on the two creeks.—*Salt Lake Tribune.*

THE LAY PRESS.

Reflections of Popular Opinion Bearing Upon the Financial and Engineering Interests of Quasi-Public Corporations.

THE IRASCIBLE CONDUCTOR—AN ESSAY IN APOLOGETICS.

"Madam," said the conductor, rather tartly, "you should have asked for a transfer when you paid your fare."

"You're a saucy fellow," replied the woman.

"Such an impudent conductor!" a third woman remarked, audibly.

The conductor said nothing, but gave the first woman a transfer. "I'm breaking a rule to oblige you," he said.

A minute later another woman boarded the car and planted herself directly in the doorway.

"Madam, you will kindly step inside the car and leave the doorway clear?" the conductor said, politely, but in a weary tone.

The woman stared at him coldly, but answered nothing and did not move.

"You will not be allowed to block the doorway," the conductor added, after a pause.

"Lay your hand on me, sir, if you dare!" the woman replied, haughtily.

"No one intends to touch you," said the conductor.

A moment later the conductor had to go to the front of the car, and in passing through the doorway he gently shouldered aside the blockading female.

"How dare you crowd me in that way!" she cried. "You did it on purpose. I shall report you."

"Report away," the conductor retorted in a surly tone.

"What a bear!" said a woman in the car.

At the next street a man, smoking a cigar, jumped on the rear platform.

"No smoking on the rear platform," said the conductor, pointing at a printed rule to that effect.

"Oh, be a good fellow," said the smoker.

"I'm sorry, but I can't afford to lose my job, said the conductor. "The company makes the rules and I obey them. Besides, some women object to tobacco smoke."

"Well, I'm not smoking," said the passenger. "I'm merely holding the cigar in my hands."

Whenever the conductor went forward to collect fares the passenger took a few furtive puffs. The conductor knew what the man was doing, and at last caught him in the act.

"Fellows like you ought to be kicked off cars, said the conductor, hotly. "Why aren't you decent? Either throw away the cigar or get off this platform." The conductor pulled the bell and stopped the car and waited. The passenger tossed the cigar into the street.

By this time the conductor was in a most irascible state of mind. Passengers bunched at the doorway and made ingress difficult for others. One man attempted to pass a bad coin on the conductor, and another pretended not to hear repeated calls of "fare please!" until the conductor tapped him on the shoulder and sharply ordered him to dig up a nickle. The passenger became very indignant at this treatment and wrangled for a minute or two with the conductor. A woman attempted to step off the car backward while the car was moving, and the conductor rebuked her by asking if she was trying to commit suicide. She retorted that it was none of his business. "You'd probably sue the company for damages if you were hurt," he replied.

Then an old woman got aboard. She was feeble and slow and she delayed the car. The conductor rang the bell impatiently and started the car a second too soon. The sudden start threw the old woman off her balance, but the conductor prevented her from falling.

"Why don't you wait until people are on the car?" a male passenger demanded.

"Conductors are all so rude nowadays," another passenger remarked. "It is probably the fault of the union."

"I beg your pardon, madam," said the conductor humbly, to the old woman.

A few blocks further on, the car having been pretty well cleared of passengers, the conductor fell into conversation with a regular traveler on the line with whose face he was familar.

"I was hasty in starting the car when that old woman was getting aboard," he said, apologetically, "and I felt ashamed of myself. But this work is wearing on the nerves, and a man would be more than human to keep his patience all of the time. You hear a good deal about discourteous conductors, but what about discourteous passengers? People ought to make some allowance for a conductor, but they don't. The work is hard enough without quarreling. Conductors don't enjoy fighting with passengers. Most conductors stand a good deal more rudeness than they ought to stand, but after a few years on the cars a man comes to feel that it is easier to take discourtesy than to bicker. It's all in a day's work, I suppose, but it is not pleasant to be a servant of the public. Most people are unreasonable and are petty tyrants. Sometimes I hate the public as a whole. The perfect conductor requires the patience of Job and all the virtues of all the saints." —*San Francisco Bulletin.*

TRADE CATALOGUES RECEIVED.

"LOW SERVICE COMPRESSION FOR AIR AND GAS," Bulletin L 511 of the Laidlaw-Dunn-Gordon Company, illustrating and describing Meyer and Corliss steam valve gears.

"SYNOPSIS OF THE 'S.K.C.' SYSTEM," being a forty-four-page illustrated pamphlet briefly describing the principal products of the Stanley Electric Manufacturing Company.

"ELECTRICALLY DRIVEN SHOPS," being special publication No. 7008 of the Westinghouse Electric and Manufacturing Company, containing a profusely illustrated paper read by Robert L. Warner before the meeting of the New England Railroad Club, December 8, 1902.

"ANNEALING, HARDENING, TEMPERING AND CASE HARDENING," a booklet discussing the effect of heat on metals and describing Braun's forge and tempering furnace, as well as the principles upon which it is built. Gratis. F. W. Braun Company, Los Angeles and San Francisco.

NEW PUBLICATIONS.

The State Mining Bureau has just issued three publications that are replete and will be of great value to all who are interested in the mines of Kern County and the oil fields at large. These are: "Register of Mines and Minerals of Kern County" (price, 25 cents; postage, 8 cents), "A Complete Mining and Oil Wells Map of Kern County," and Bulletin No. 31, on "Chemical Analyses of California Petroleum." For copies apply to the California State Mining Bureau, Ferry Building, San Francisco.

GREASE LUBRICATION FOR AUTOMOBILES.

Where grease cups are provided on automobiles then it should be remembered that there is no grease quite so useful as a grease that contains 5 to 10 per cent. of Dixon's pure flake graphite. Such greases are made by the Dixon Company in six degrees of hardness, according to the heat that they are to withstand. Grease lubrication is more economical than oil lubrication and is better in many ways.

ALLIS-CHALMERS-BULLOCK AT THE EXPOSITION.

Machinery Hall, unlike the other buildings at the St. Louis World's Fair, is not closed in the evening. It is open until 11 p. m., and visitors in the evening will find at work there, among other objects of interest, the big 5000 horsepower Allis-Chalmers-Bullock engine and generator producing the electric current to keep aglow the 120,000 or more decorative lights which glitter all over the buildings and grounds.